# SUPPLEMENT TO THE "REVISION OF THE TEREBRATULIDÆ," WITH ADDITIONS, CORRECTIONS AND A REVISION OF THE CRANIIDÆ AND DISCINIDÆ.

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Since the publication of the paper above referred to, much new material and many new facts have come to hand. To such an extent has this been the case, that I have been impelled to offer a supplement, which, besides containing additions and corrections, should also furnish a ready list of the other species of recent brachiopods not included in the first paper, so that the two taken together might form for the student of these animals a sort of index of reference. While doing this I am well aware that I cannot hope to escape errors, and trust that such as may occur may receive as speedy and thorough refutation as the progress of science demands. Accuracy being the one thing needful in all scientific work, no one should regret any advance toward it, whether it militate for or against his individual views.

I have to express my great obligations to various authors for kindly and valuable criticism and assistance in my work, and to none more than to Thos. Davidson, Esq., F. G. S., whose paleontological studies among the members of this group, stand almost unique among monographs, as do those of Barrande among cephalopods and trilobites. To J. Gwyn Jeffreys, Esq. and Mr. E. Billings I am under obligations; I have also to express my indebtedness to Prof. Agassiz, who, with the kind concurrence of Count Pourtales and Dr. Wm. Stimpson, has afforded me the opportunity of examining and dissecting series of the brachiopods obtained in the well known deep sea dredgings of the U. S. Coast Survey on the course of the Gulf Stream. The report upon them will be published by the Museum of Comparative Zoology.

In the preliminary portion of my first paper on the Brachiopods, I indulged in some brief remarks on the systematic position of the group. These remarks were prompted, it is true, by some recent publications of Prof. E. S. Morse, but were rather intended as a statement of the case, than as a criticism upon the special views put forward by that gentleman. However, he has seen fit to regard them in the latter light, and has complained that they were not in the nature of impartial criticism.* I sincerely regret that such should be his feeling, and can only state in defence, that they were not intended as a criticism, but as a statement of certain important characteristics of the various groups compared, and hence could not include much reference to the many trivial and irrelevant facts which he had brought forward in support of his theories.

I propose, however, at present to meet him on his own ground, and to give at the same time as thorough a statement of the case from my point of view, and as impartial review of all the facts as the case will admit.

As it is impossible to solve an algebraic problem without affixing a definite value to some of its terms, so it is impossible to fairly discuss any theory until the ground upon which the different parties stand, is clearly defined.

Prof. Morse has advanced two theories, but has mainly directed his efforts to the sustentation of the second of them. They are, 1st. The brachiopods present a comprehensive type. 2d. The brachiopods are not mollusks, but a subdivision of the annelids.

It seems to me that these two statements are irreconcilable.

In the first view I am inclined to agree with Prof. Morse to a certain extent. In the second, I am entirely unable to agree with him.

It is evident that much, if not all, the discussion must turn upon the point, what is a mollusk or molluscoid, and what is an annelid, or, in general terms, a worm.

I have repeatedly desired Prof. Morse to define these two types from his standpoint, and he has never responded. Is it, therefore, to be supposed that he has no clear ideas upon these subjects, or that he fears that any definition would so expose the weakness of his theory as to insure its immediate rejection? It would, perhaps, be hardly fair to draw such conclusions.

For my own part, I am quite willing to define my views and position with regard to the question in detail; though I am as conscious that there are others who might state the case far more ably than myself. If any one person, by some miraculous gift, were able to study all the forms which have lived upon the earth since it first became habitable, and that person was also gifted with the mental attributes necessary for the comprehension of all their structural characters; few would assert that such study would reveal sharp lines of demarkation between vertebrates and invertebrates, mollusks and annulosa, radiates and protozoans. On the contrary, we know that with the very limited knowledge which we possess of the forms inhabiting the earth at the present period, there are such close approximations between members of the different great groups as to render it a matter of great difficulty to refer them to their proper places in the natural system. This difficulty has seemed so insuperable to some of the most eminent naturalists of the present day, that they have entirely rejected the great groups (representing different fundamental types of structure to Cuvier) and have substituted a larger number of smaller ones; and even of some of these small groups the boundaries are a matter of discussion.

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* Silliman's Am. Journ., Sci. and Arts, Feb., 1871, p. 136.

Under these circumstances, we should naturally expect to find among the older types of animal life, a more generalized structure than in those of later development, and that the living representatives of these old types should be among those which offer the greatest difficulties in referring them to a definite place in our systems.

For my own part I confess I incline to the belief that, after eliminating the *Protozoa*, the revised sub-kingdoms or embranchments of Cuvier have still a meaning and a value, though not such as he ascribed to them. Among the lower invertebrates, however, there are many forms which, from their simplicity, offer few characters; and in such cases we can only strike the balance and refer them to places indicated by the majority of their characteristic features. This process must always depend, to some extent, upon the individual opinion of the particular student, and while the majority of naturalists may be united upon a given question, there may be others who view the subject differently upon the same evidence. It does not appear to me that the brachiopods can be included in this category of doubtful forms. Indeed, their class and ordinal characters seem to indicate their position with sufficient clearness to admit of no doubt upon the subject.

Before proceeding to discuss this point, however, I shall define, to the best of my ability, the groups under consideration, and then show, as far as may be, the grounds upon which I consider the brachiopods to belong to one, rather than to another group; after which I propose to take up separately each of Prof. Morse's supposed homologies, and sift it as thoroughly and impartially as possible. In the first place, the *Mollusca*, including both the typical forms and the *Molluscoidea*, appear to present the following characters as typical features of structure:

## Type MOLLUSCA, Cuvier (emend.)

*Heterogangliata*, Owen, 1835. *Saccata*, Morse and Hyatt, 1865.

Animals characterized by the development of organs singly or in single pairs,* with the inarticulated, non-radiated soft parts enveloped in a sac† or mantle of varied form, which secretes the usually external hard parts, if any exist, and which is invariably pierced for the oral aperture, and generally more or less open elsewhere; furnished with a mouth and intestine which is bent more or less upon itself; with a nervous ganglion below the oral opening and usually nervous cords therefrom, forming a ring about the œsophagus; other ganglia, if any, distributed in a scattered manner and never along a pair of symmetrical, sub-abdominal, median cords ‡. Animals free, or having an organic connection with extraneous objects.

The respiratory, reproductive and circulatory systems are so variable and offer such wide discrepancies, that no characters are afforded by them for the typical diagnosis.

The same may be said of their embryology. The type, or sub-kingdom, offers two sub-types or divisions, but we have not the data to exactly define the limits of the gap between them. The following diagnoses are generally applicable.

### Sub-type MOLLUSCA VERA.

Mollusca having three principal ganglia (or pairs of ganglia); a heart and a circulation within definite vessels; the heart situated on the opposite side of the intestinal canal from the sub-œsophageal ganglion or encircling the intestine, or rarely double or possessing accessory "pulsatile vesicles," (as in the cephalopods) in connection with the branchial arteries; reproducing by ova only; breathing free air or water; usually possessing a "water-vascular" system.

This subdivision presents three well marked classes, the *Cephalopoda*, *Gasteropoda* and *Conchifera*, which are, however, of very unequal value. The last is much more widely separated from either of the others than they are from each other, and, as has been pointed out by Morse and others, may be regarded as the typical group of the sub-kingdom. The pteropods present no features of class value, much less the heteropods.

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* *Clark*, Mind in Nature, p. 195, 1865.

† *Morse*, Class. Moll. on the principle of Cephalization, Com. Essex Inst. p. 178, 1865.

‡ *Owen*, Enc. Brit. Art. Mollusca; Ed. viii, p. 320, vol. xv, 1858. The nerves of the appendix in *Appendicularia* are furnished with successive dilations, but they are not sub-abdominal nor bilaterally symmetrical, being on each side irregularly distributed without reference to those on the opposite side.

The fact that the pulmonates have been separated as a distinct class by Huxley* excites surprise, as the characters given are insufficient for such a distinction, and very gradual transitions toward the other gasteropods may be pointed out. The flexure of the intestine varies greatly, and is by no means a constant character.

A transition between the lamellibranchs and tunicates is indicated through the genus *Rhodosoma* (*Schizascus*, Stimpson) and Prof. Morse observes † "the relations between the tunicates and lamellibranchs are too obvious to indicate." It has been proposed by Girard to combine the Planarian worms with the mollusks on embryological and anatomical grounds; and by Mœrch that the trematodes, cestodes and other low forms of worms should also be transferred to this sub-kingdom, but their obvious affinities, in spite of their simplicity of structure, have deterred other naturalists from following these examples.

In some points of their structure, the brachiopods are allied to the Conchifera, and by others to the cephalopods and some aberrant groups of gasteropods. So intercrossed are the threads of affinity, that a kind of reticulation is the result, and it is far more easy to point out these features than to assert for some a preponderance over all others.

The heart (though far more simple) of the brachiopods with its accessory "hearts," or "pulsatile vesicles" and their relations to the blood vessels which supply the branchial apparatus, is closely paralleled both in appearance and in function, in the so-called "branchial hearts" of the cephalopods.‡ In the conchifers also a notable dilatation of the blood vessels§ on their entry into the branchiæ may be observed, though not differentiated as strongly as in the others.‖ The heart lies free upon the intestine in *Anomia*¶, much as it does in *Terebratula*, and the greatly enlarged oral "tentacles," the absence of other branchiæ, or of a large, well differentiated "foot," as well as the complex muscular system and the peduncular attachment, all recall a somewhat similar state of things which exists in the brachiopods. In some cases among the lamellibranchs we find two distinct hearts.[*] The young conchifer is attached in the beginning by a byssiform peduncle, is without lamelliform gills, and respires by the vascular and ciliated surface of the mantle lobes, and has two distinct hearts.[†] They are sometimes furnished with setæ or bristles (*speischen*) upon the mantle lobes in their larval condition, as in *Anodon.*

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* Introduction to the Classification of Animals, p. 39, 1869.

† Class. Moll. on the Basis of Cephalization, Com. Essex Inst. p. 176, 1865.

‡ See Bronn, Kl. and Ordn. Thierr. 2d Abth. Taf. cxvii.

§ The circulating vessels are most simple in the aberrant *Solenoconchæ*.

‖ Garner, Tr. Zool. Soc. Lond., ii, p. 90, 1841.

¶ Ibid. l. c. p. 91.

The gap between the conchifers and gasteropods presents no well marked interruptions, though the *Dentaliidæ* and some pteropods, perhaps come nearer than any others toward bridging it.

The genitalia, respiratory apparatus, embryology and the curves of the alimentary canal present such differences and modifications that it is impossible to generalize briefly upon them in this sub-division.

The blood is sometimes colored, but more generally translucent.

The oral aperture and efferent orifice (when the latter exists, as it usually does) are, in the majority of cases, contiguous.

Striated muscular fiber has not yet been detected in the cephalopods, but is known to exist in members of the other two classes.[‡]

Many conchifers are attached by a more or less permanent byssus, and some gasteropods, as well as conchifers, are attached by the calcareous matter of their external shells, to which they are organically fixed by muscles.

One group among the gasteropods merits special attention, on account of the many points in which it offers some analogy with articulate animals. I refer to the *Polyplacophora* or chitons. This remarkable order, in its dorsal vessels and (in some cases) fasciculated setæ, resembles the annelids; in its differentiated carapax-like head (in the young condition) and successive hard plates recalls the crustacea; while its symmetrical genitalia and lateral branchiæ bear a distant relation to those of the conchifers. It is to be observed, however, that the apparent segmentation is confined to the valves and fasciculated setæ, and that the internal organs present no similar series of repetitions. The head and foot, odontophore, nervous system and alimentary canal are typically molluscan, and of the balance of characters there can be no doubt. The eyes, present in the young, are lost in the adult condition; the pores of the girdle, though perhaps not homologous, present some analogies with the perforations of the

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[*] Huxley, Intr. Class. p. 34, 1869.

[†] Owen, Lect. Comp. Anat. Inv. p. 528.

*Dall* On striated muscular fiber in the Gasteropoda, Silliman's Am. Journ. Sci. and Arts, Feb. 1871, p. 123.

*Terebratulidæ* and in some forms, as among the brachiopods, are wanting.

It is noticeable that if a diagram be made of a chiton with ambient branchiæ, in the position which it assumes when removed from its station on a rock, that the position of the oviducts, branchiæ and heart resembles that of the same structures in the *molluscoidea*, but with the position of the heart reversed in relation to the ganglion, indicating the position of the group to be among the typical mollusks. I observe a character, which, in one sense, may be termed degradational; that is, that there appears to be a sort of fading out of the characters of the anterior part of the body, so that the oviducts, heart, and in many cases the branchiæ, are more or less concentrated toward the posterior end of the body. It has been stated that the branchiæ proceed from the tail toward the head, but this appears to me to be incorrect. In all the chitons I have examined, the branchiæ point toward the tail, even when wanting in the cephalic region, and there is always a space entirely without branchiæ at the posterior extremity. In the chitons with ambient gills, no such space occurs in front, the arteries and nerves are most emphasized anteriorly, so that I am forced to the conclusion that the branchial cordon really springs from the cephalic region as in the limpets, though very different in character from theirs.

The annulated mantle filaments of *Lima* recall the similarly annulated setæ of some brachiopods, though no homology is intended to be indicated by this observation. (See Forbes and Hanley, Brit. Moll. i, pl. R.)

## Sub-type MOLLUSCOIDEA.

Mollusca having one principal subœsophageal ganglion or pair of ganglia; provided with an *atrial* system; hæmal vessels more or less imperfect; heart provided with accessory "pulsatile vesicles," imperfect, or entirely absent; when present, situated on the same side of the intestinal canal as the ganglion, though through the flexure of the intestine, it is often on the opposite side of the body, and thus apparently, but not really, on the opposite side of the intestine;* respiratory apparatus about, and to a greater or less extent surrounding, the mouth or oral aperture; reproduction by gemmation or ova; breathing water only.

While the classes included in the above diagnosis possess the

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*Those cases which form exceptions to this general rule also exhibit abnormal relations, in position, of the other parts, and are to the normal forms as the sinistral varieties of *Buccinum* are to the typical dextral form of the particular species.

aforesaid points in common, many other characters peculiar to the individual classes are very diverse. In no point is this more marked than in their embryology. The whole sub-type has been removed from the mollusca by Mœrch, while Prof. Morse, leaving the ascidians (the most aberrant of all, and presenting more than any other molluscoid group features which suggest affinities with the *Annulosa*) with the mollusks, removes the Brachiopods and Polyzoa and degrades to the rank of a subdivision of the Annelids, two groups almost universally recognized as having the value of classes. At the same time Dr. Mœrch would annex the *Plathelminthæ*, Trematodes, Cestodes and *Turbellariæ*, to the *Mollusca*. Hæckel, Gegenbaur and others, while leaving the brachiopods with the mollusks, would carry to the *Annulosa* the *Polyzoa* and *Tunicata*. While disagreeing with all these various efforts at dismembering the molluscan type, I cannot but admit that, in the case of the Ascidians, at least, they are not without some basis, though, as I suppose, an insufficient one, but the classification which would leave these last with mollusks, while depriving them of their companions the Polyzoa and Brachiopods, would seem the most unphilosophical of all.

Among the characters of this group which, from their inconstancy have little value, or are of value only in subordinate groups, I may mention the fact that the circulating fluid (whether due to the presence of hæmoglobin or to other causes) differs in color, being in the majority translucent, but varying from bluish to red or even brownish in some forms, while others, closely allied, have no such features.

The majority of the Tunicates and Brachiopods, and all, or nearly all, of the Polyzoa are fixed by an extension of the tegumentary covering, which is usually of a horny texture, or by the calcareous shell which is secreted by the mantle; but this character is not constant, even within the same genus, and a great many brachiopods and tunicaries are entirely free.

Transversely striated muscular fiber is found in many but scattered instances, and, as a systematic character, cannot be considered as of value.

The modifications of the breathing organs are numerous, but the apparatus as a whole preserves the same general relation to the mouth—as regards its position.

The vascular system is not thoroughly understood but exhibits great diversities.

The ovary is usually on the same side of the intestine as, and near to, the heart, but this is not universal. In many forms the ova undergo a sort of incubation before being expelled into the surrounding medium. The Polyzoa and some Ascidians are gemmiparous or propagate by buds as well as by eggs.

The most extraordinary manner in which some Ascidians are developed, as worked out by Kovalevsky and others, would, in a strictly embryological classification, place them in the vertebrata. On the other hand, other nearly allied species are without the singular features referred to, in their embryonic condition. This may be referred to the suppression of certain stages by some naturalists; yet, the very admission that suppression of characters in the embryonic progress is possible, undermines the whole value of embryology as an assistant in systematic classification; for who shall say when or to what extent suppression may not have occurred and what essential features of embryonic life may not have been lost thus in any given case?

It has been stated that the flexure of the intestine in *Appendicularia* is radically different from that of the other tunicaries, but this does not appear by the later researches of Moss.* On the other hand, Mr. Alder describes certain species of *Ascidiæ* (*A. parallelogramma*, and *Phallusia turcica*) as having the intestine flexed in a different direction from that which usually obtains. These facts are further proofs of the little dependence to be placed upon this character as a basis for classification.

For our present purpose it is unnecessary to define the *Tunicata* and *Polyzoa*, and for the sake of brevity I shall confine myself to giving a definition of the class *Brachiopoda*. Attention should be directed, however, to the homologies between the *Polyzoa* and *Conchifera*, as suggested by *Rhabdopleura* and worked out by that well-known student of the *Polyzoa*, Mr. Allman.† The homologies between tunicates and conchifers, drawn by Allman and Hancock, masters of the subject, are well known.

## Class *BRACHIOPODA*.

Animals provided with a shelly covering composed of two valves, each of which is normally bilaterally symmetrical, and to which it is organically attached by three principal pairs of muscles. Soft parts also bilaterally symmetrical; consisting essentially of a mantle composed of two lobes, to which the valves correspond, of which lobes the outer edges are disunited throughout the greater part, or the whole of their extent; a disk of membrane, variously modified in form, with its edges fringed with a series of tubular brachia; the mouth situated within this disk at its posterior portion; a stomach with a more or less anteriorly recurved intestine; a circulatory system, more or less confined within closed vessels, furnished with a heart and sometimes one or two pair of accessory "pulsatile vesicles," and a series of sinuses between the laminæ composing the lobes of the mantle; diœcious (?) with the genitalia usually suspended in the sinuses of the mantle lobes; the genital products expelled through one or two pairs of oviducts opening externally; principal nervous ganglia below the œsophagus encircling it with nerve filaments; respiration performed by direct contact of the sea water with the vascular tissues of the brachia and mantle-lobes; reproducing by ova only.

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* Trans. Lin. Soc. Vol. xxvii, Part ii, p. 299, pl. xlvii, 1870.

† Journal of Microscopical Science, N. S. ix, p. 63, 1869.

The above diagnosis includes *all* the characters *common to the class* (which are not included in the definition of the type and the subdivision to which this group belongs, according to my views and those of much more eminent and competent naturalists) which, after much study and reflection, I have been able to discover.

I shall, further, assume that no characters not constituting a large share, or possessing a preponderating value, in the definition of the class, or not contained in such an impartial definition, shall be taken as proofs of the position of the class in a natural system of classification. In this assumption I think I am sustained by logic, common sense and the usual practice of naturalists.

It will be noted that I have excluded from this definition any allusion to peduncular or other attachment. I have not done this without due consideration, but the fact that this character is not even of family value, will amply justify the omission. The *Rhynchonellidæ*, *Thecidiidæ*, *Spiriferidæ*, *Strophomenidæ*, *Productidæ*, *Craniidæ*, and even the *Lingulidæ*, offer examples of pedunculated and non-pedunculated, free and attached forms, when the fossil forms are considered, and these comprise all but two of the families of *Brachiopoda* admitted by Mr. Davidson in his well-known works.

The oviducts differ within the same family from a simple perforation of the perivisceral tissues surrounded by distant papilla-like elevations of the membranes, to a complex organ such as exists in *Waldheimia* and *Lingula.*

Some genera are undoubtably diœcious, and all may prove so, but this is not yet fully determined.

Setæ on the mantle edge are not constant characters in the same family, or even in the same individual at different ages.

The embryology is yet imperfectly known. A larva, supposed to be that of a brachiopod, was figured by Fritz Müller, but it has never been confirmed, and still remains in doubt. The researches of Prof. Morse (which agree with my own upon other species) do not indicate a strict metamorphosis, such as would be inferred from Müller's figure, and apparently exists in *Thecidium*, as shown by the researches of Lacaze Duthiers. It is probable that the embryonic stages differ widely in different forms of Brachiopods, as they do in the Ascidians and other groups; and no reliance can be placed upon them in classification, as far as can be judged at present.

The position of the valves with relation to the animal has been a subject of discussion. It would appear from the paper of Lacaze Duthiers* that they are anterior and posterior, being articulated across the back, and consequently both dorsal. I have elsewhere called them hæmal and neural respectively, as more expressive and correct terms than dorsal and ventral. This opinion had been previously expressed by Huxley, Hancock,† Jeffreys and others. This relation, however, may not be constant throughout the group, as, for instance, in *Lingula*.

The embryos of *Thecidium* are divided into segments like those of some Pteropods, *Dentalium* and *Chiton*. Nothing of the kind, however, is indicated in Morse's notes on the embryonic stages of *Terebratulina caput-serpentis*.‡

Prof. Morse at one time put forth the theory§ that the pedunculated or middle dorsal end of the Brachiopods was the anterior end, but this being opposed to all known anatomical and embryological facts he has since withdrawn it.

One character common to all the Brachiopods which I have examined, and perhaps universal, consists in having a projection of the posterior oral labium fitting into a depression in the anterior labium, and much resembling the "epistome" in *Polyzoa*. This is a character of apparently little structural importance, however, and further observations are necessary to establish its constancy throughout the class.

The relations of this class with the *Polyzoa* are unquestionable, and may be compared to the relation existing between the Cephalopods and Gasteropods in the typical Mollusca, while the *Tunicata*, on the one hand, and the *Lamellibranchiata*, on the other, stand somewhat aloof,‖ and are perhaps closer to each other than any other two classes of the respective subtypes.

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* Annales Sci. Nat. 4th ser. Zool. xv, p. 332, 1861.

† Trans. Roy. Soc. 1858, p. 851.

‡ Am. Naturalist, Sept. 1869, p. 385.

§ Comm. Essex Inst. iv, p. 173, 1865.

‖ Lacaze Duthiers (Comptes Rendus, Nov. 6, 1865, p. 800) remarks: "Do we not find an Ascidian (*Chevreulius* = *Rhodosoma* or *Schizascus*) presenting symmetrical muscles analogous to those of the *Terebratulæ*, and this merely because its tunic has become bivalve, and without our

In this connection it may not be unfair to quote Prof. Morse himself: "We find (in *Lingula*) the intestine also running parallel with the sides of the body, at its posterior portion becoming convoluted and terminating on the right side, the straight part producing a curve arching toward the hæmal valve and surmounted by a heart as we witness in most Lamellibranchiata, showing clearly in this view alone its homological identity with the Lamellibranchiata. The limits of this paper will not allow us to carry homologies from this point to the other two classes of Mollusca, and in fact it would be hardly necessary to do so, as the path is rendered apparent and plain through the medium of Lamellibranchiates." While no one will deny to naturalists the right to modify their opinions on the development of new facts in science, it seems strange that, after pointing out the obvious homologies of two groups so forcibly as in the paragraph I have just quoted (Proc. Boston Soc. Nat. Hist. ix, p. 60, 1862), the gentleman in question should turn his back on his expressed opinions, while the facts still remain undeniable and undisputed.

I shall not hope to succeed in or even to essay the definition of the type which essentially corresponds to the *Articulata* of Cuvier, which has defied the best efforts of the most eminent naturalists. It might almost be said that they are characterized by diversity in the development of special features of structure, with a marked tendency to the repetition of similar organs or groups of organs antero-posteriorly, in bilateral symmetry. This diversity exhibits itself no less in the distinct classes than in the entire group of animals. The different subdivisions are united by features which are more or less characteristic of small groups, which at the same time present vestiges of other characters, which are typical of other small groups, and so the frequently interrupted threads of affinity, though binding the mass more or less completely together, nevertheless exhibit a notable want of continuity.

I trust I shall not be accused of undue attachment to broken idols when I remark that the group *Annuloida* of Huxley appears to me to be heterogeneous and unsatisfactory. With the exception of the Echinoderms, it might advantageously be combined with the *Annulosa* without violence to their affinities.

We now come to the Annelids, the group to which Prof. Morse

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being able to remove it from the group (*Tunicata*) to which it belongs?" And also, "If we suppress in the lamellibranchiate Acephalan the foot and the pedal ganglia, there remains an organism having the greatest analogy with that of the Brachiopod, always excepting the position of the valves."

would transport the Brachiopods and Polyzoa. We do not suppose that under this head he includes the Scolecid worms, although he has borrowed a few characters from them to complete his catalogue of supposed affinities. He has distinctly specified this as the group of which the Brachiopods are a mere subdivision, and hence cannot call upon us to prove that they are not also a subdivision of the *Scolecida*,* if that were possible.

### Class *ANNELIDA*.

=*Polychæta*, *Oligochæta* and *Gephyrea*.

Animals *of elongated form*, characterized by a *successive repetition of pairs of similar organs or single organs representing pairs*, *enclosed in a muscular tunic*, *apart from the true skin*, which is or is not differentiated into segments (corresponding to the successive groups of organs) by successive constrictions and internal dissepiments.

*Nervous system consisting of two median cords* (separated or combined throughout the greater part of their extent) *connecting a series of subabdominal ganglia*, from which nervous filaments are given out, each ganglion corresponding to a segment, if segmentation or repetition be exhibited; *these cords are united above the œsophagus*, *near or in front of the oral aperture;* connected or non-connected by a subœsophageal nerve.

Circulation without vessels of any kind, or without a differentiated heart, when contained within closed vessels, in which case there is usually a dorsal vessel. Blood colored or uncolored.

Branchiæ external, internal or wanting; attached either at the anterior or the posterior extremity.

Genitalia usually repeated in every segment after the first few anterior segments. Monœcious or diœcious; with or without copulatory organs.

Reproducing by ova or fission; frequently exhibiting two or more sexual forms.

*Absolutely free from any organic connection with extraneous objects*, but often forming tubes of sand, mud or calcareous matter, or occupying the vacant receptacles of other animals.

With or without fasciculated chitinous setæ of varied form; with or without a "segmental organ;" with or without eyes, with or without "*porenkanale*."

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* It is hardly to be supposed that Professor Morse is opposed to the course of all modern students of the group, and would, in opposition to their views, unite the Scolecids with the Annelids in one heterogeneous class.

*Alimentary canal without a differentiated stomach;* usually straight with a posterior anus and anterior mouth, but these latter characters do not apply to some of the *Gephyrea*, which have a mouth which is not anterior, an anus either anterior or posterior, or no anus at all; with a convoluted intestine.

Terrestrial, fluviatile or marine in habitat.

The above very qualified diagnosis well illustrates the prevailing diversity of the forms of this type, and may itself require further qualification. The only portions of it which appear to be essentially universal are those in italics.

The subclass *Gephyrea* contains many aberrant forms, once associated with the Trepangs. The greatest variations occur in this group. Jourdain* found in four species of *Sipunculi* three without an anus and the other with a posterior anus. Keferstein and Ehlers† describe *Sipunculus nudus* and *tesselatus* as having a posterior anus. The *Aspidosiphonidæ* are characterized by a dorsal anus, the *Loxosiphonidæ* by a terminal anus,‡ and in the other groups this character varies greatly. Most of these forms have colorless blood, as do all the *Aphroditacea* (and many others) among the typical Annelids §

The "segmental organ" described by Dr. Williams,‖ its discoverer, as prevailing "throughout the *Actiniidæ* (*Acalephæ*) *Echinodermata*, *Rotifera* and *Annelida*," is stated by Claparède¶ to be wanting in some Annelids, or reduced to simple apertures in the wall of the body, or wanting an internal orifice, as in some *Capitellea ;* it also exists in the anterior segments of many Annelids in which the genital products do not penetrate to that region. Its wall is often glandular and it can hardly be doubted that it also plays an excrementitial part. In the *Oligochæta* only a small number of these organs are modified for the purpose of conducting outward the sexual elements, while the rest incontestably fulfil other functions. The same is true of the *Polychæta.* The "*porenkanale*" occur only in the species with a thick cuticle, and not even in all these. They are tubular pores corresponding with subadjacent cells. (Claparéde, *loc. cit.*)

Pores for the discharge of certain secretions appear to exist in all species of Annelids. (Ib.)

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* Comptes Rendus, April, 1867, p. 871–3.

† Bull. Sci. 1861, p. 387.

‡ Baird, P. Z. S., 1868, pp. 76–114.

§ Owen, Comp. Anat. Inv. p. 246.

‖ Proc. Royal Soc. viii, p. 371–6, 1857. An. Nat. Hist., Second Ser., xix, p. 393–7, 1857.

¶ Annals Nat. Hist. 3d Series, xx, p. 355–6, 1867, and Biblioth. Univ. Arch. Sci. p. 1–44, Sept., 1867, and also in Introduction to his work on the Annelids of the Bay of Naples, 1868.

The branchiæ are anterior and external in *Serpula*, posterior and internal in *Bonellia* and many *Gephyrea*, and rarely form a continuous disk encircling the mouth, as is universal in *Brachiopoda*.

Most, if not all, of the true Annelids are provided with a "trompe," a curious organ contained within the œsophageal cavity, exsertile, and usually furnished with denticles; and many of the Annelids have strong horny jaws or lateral mandibles, somewhat as in insects; none of these structures are found in the entire group of *Molluscoidea*, including the *Brachiopoda*.

In fact, if the typical characters of the Annelids as a group are compared with those of the Brachiopods, it will be seen that all the important features of each are incompatible or diametrically opposed to those of the other group, respectively.*

That the Brachiopods form a "comprehensive type," in the wide sense in which Prof. Morse seems to imply, I cannot admit, as they are a well-defined group whose characters as here shown (I trust and believe impartially), are distinctly allied to those of the other groups included in the *Molluscoidea* and, through their combined characters, to the typical *Mollusca*. That they are a peculiar group, exhibiting a few characters not shared by their associates, and indicating a distant affinity with animals not included in the type or sub-kingdom, I am willing to allow. That these faint evidences are sufficient to authorize their deportation and degradation to a subordinate place among the Annelids, I consider unreasonable.

In the light of the facts previously set forth I will now proceed to sift the homologies and asserted affinities claimed by Prof. Morse in his original paper † and his subsequent publications. I should have preferred to await the publication of his complete memoir, but it may safely be assumed that had he possessed any more cogent arguments he would not have failed to bring them forward, and the facts upon which my own arguments are based are mostly of long standing and unquestioned by any one, so that they can hardly be affected in any way by Prof. Morse's coming work.

Prof. Morse's remarks are in italics, for brevity and to save tautology.

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* Quatrefages defines the Annelids as "essentially diœcious animals, composed of segments which repeat themselves and bear on each side a perfectly characteristic organ—a foot armed with exsertile and retractile setæ." But the learned *savant* does not include the *Oligochæta* and *Gephyrea*, as do most modern naturalists. Cf. An. Mag. Nat. Hist. xvii, p. 5, 1866.

† Am. Journ. Sci. Arts, Vol. 50, July, 1870.

1. *Relations between the cœcal prolongations of the mantle in Terebratula and a similar character in the test of Crustacea. Resemblance between the polygonal cells in the shell of a young Discina and a similar feature in certain lower crustaceans. The scale-like structure of the test of Idotœa like the scale-like structure of Lingula.*

These characters are too vague to meet, and are histological and not systematic in any case. Were they sustained as correct they would in no way affect the question. What, it may be asked, is the "*scale-like* structure of *Lingula?*" Dr. Carpenter records nothing of the kind in his admirable researches into the structure of the shells of the *Brachiopoda.*

2. *The skin of Nereis has similar punctures or dots, as seen in Terebratula and the peduncle of Lingula.*

The "*porenkanale*" are cœcal tubes, opening outwardly, closed at their inner end, and lined with an invagination of the external cuticle. (See Claparède *anté*, and also in *Recherches sur des Annelides*, Geneva, 1869, p. 14.) The punctures of the shell in *Terebratula* are precisely the reverse, being lined by outward prolongations of the mantle from the inside, and cœcal at their outer extremity. I have failed, with the most careful search and high powers, to discover any punctures on the peduncle of *Lingula Murphiana* and *L. hians.* It should be remembered that when Prof. Morse speaks of *Lingula*, in most cases he refers to a species of *Glottidia* (*G. pyramidata*, Stm.)

3. *The shell of Discina chitinous and that of Lingula, phosphatic rather than cretaceous.*

The fact of such differences existing between two nearly allied genera is sufficient proof that they are of little systematic value, even if chemistry were allowed to have any bearing on systematic classification, which is more than doubtful.

4. *Valves of all Brachiopods, dorsal and ventral, a strong articulate character.*

The first statement is almost certainly an error (cf. anté), and many, if not most, Articulates are without ventral plates. (Cf. Marey, Lect. on Flight in the Animal Kingdom, with regard to Insects, and any work on the Cypridian crustacea.)

5. *Horny setæ entirely absent in the Mollusca, and peculiar to the worms.*

The first statement was refuted in my first paper on the Brachiopods, and the second is erroneous. All of the *Scolecida* and some Annelids are without setæ, which are not characters of class value, and are absent in many Brachiopods, as before shown. Nevertheless the presence of setæ may be allowed to be indicative of faint articulate affinities, as in the case of *Chiton*.

6. *Setæ of Brachiopods moved freely by the animal, and identical in structure with those of the worms.*

The first statement needs confirmation, and at any rate can refer to very few Brachiopods, and I have already proved that they are far from being identical with those of the Annelids. Neither do they bear the same position with regard to the other parts as in the worms.

7. *Resemblance between the lophophore of Brachiopods and a similar structure in the tubicolous worms.*

This resemblance is very distant, and the structure is totally dissimilar. The homology between the anterior segments of *Sabella* and the mantle of Brachiopods, which follows, is superficial and erroneous to an extraordinary degree, as any one who will take the trouble to look at the two structures may readily perceive. The organization of the two animals is so utterly different that any such homology is impossible.

8. *Thin and muscular visceral walls suggest similar parts in the worms.*

This is obscure, and it is impossible to say whether it refers to the walls of the viscera or of the visceral cavity. Those of the viscera in Brachiopods are anything but thin, and it is difficult to see the bearing of the observation in any case, as the character of the visceral walls is of no systematic importance.

9. *Lamellæ on the internal surface of the mantle in Balanus and Lingula.*

The discovery of branchial lamellæ on the mantle of *Glottidia*, discovered by Prof. Morse, is exceedingly interesting and a valuable contribution to our knowledge of the group. It remains, however, to be seen whether it also occurs in *Lingula* proper. As to its homologies, they may as well be sought in the *Patellidæ* and *Siphonariidæ* as among the Cirrhipedes. With regard to the position of the ovaries in the latter and in the Brachiopods, the homology needs confirmation, and the fact is of very doubtful importance in classification, especially when we remember the varied position of the ovary in the true mollusks.

10. *Relation between the statoblasts of Polyzoa, the ephippia of Daphne, and the winter eggs of Rotifers.*

It is difficult to see the special value of the external appearances of eggs which produce very different animals. Our business is rather with the contents than with the shells. Eggs are very much alike all the world over, whether they be those of mollusks, salamanders, or fish, birds, or turtles. Moreover, the eggs of many of the Brachiopods, as I have had numerous opportunities of noting, are quite spherical, and differ as much from those of *Polyzoa* and some other Brachiopods as they do from those of very different animals.

11. *The "segmental organs," or oviducts of Brachiopods, and their close affinity to the oviducts of worms.*

The segmental organs of worms undoubtedly bear, in some cases, a resemblance in appearance and in function to the oviducts of the Brachiopods. The preceding remarks in regard to these organs in the Annelids may be referred to in this connection. There is also a somewhat similar resemblance to be traced between them and the fallopian tubes of vertebrates. Whether there be any homology between them in either case is another and an undecided question. In structure, however, the Annelidan organ is very different from that of the Brachiopods. (Cf. Claparède, Annel. Chætop. Golfe Naples, and Williams, Proc. Roy. Soc. l. c.) Moreover, they are not peculiar to these two groups, if we may believe Dr. Williams, but may also be found, or their homologues, in the Acalephs and in *Synapta.* In the Brachiopods, the term "segmental" would be a misnomer, for, shall we believe that *Rhynchonella* is composed of twice as many "segments" as *Terebratula*, with, in many respects, an almost identical organization? On the other hand, a vast number of worms are entirely without these organs (Cf. Diesing, *Bdelllideen*, Vienna, 1858, and Van Beneden, *Recherches sur la Faune lit. de Belgique*, Bruxelles, 1860), which cannot be said to be characteristic of even the whole class of *Annelida*, to say nothing of the other worms. If the Brachiopods are to be Annelidized on this single character, what shall be done with those Annelids which do not possess it?

The segmented embryo of *Thecidium* and *Dentalium* has been already referred to, as well as the fact that Prof. Morse's studies on the embryology of *Terebratulina* did not discover any segmentation in that quarter. The character cannot be considered as of value in any but the most limited sense.

12. *Bristles or setæ in larval worms and Brachiopods.*

I have already stated that the very young of *Terebratula* are without any setæ, as well as the adults of many genera of Brachiopods, and hence no systematic value in relation to the position of the class can be assigned to such features.

13. *Close resemblance in nearly every point of their structure* (of *Crepina* and *Phoronis*) *to the hippocrepian Polyzoa.*

I have already shown that this so-called "close resemblance" is confined to the fact that both have a crown of tentacles, and is otherwise entirely fallacious and non-existent.

14. *Sand tube of Lingula (=Glottidia) differing in no respect from the sand tubes of neighboring Annelids.*

An examination of this "sand tube" shows that it differs from those of Annelids in being merely sand adhering to a flocculent mass of mucus surrounding the peduncle, without firmness, persistency or any particular shape; and is, of course, formed in a totally different manner from the tubes of any Annelid. The colored blood noticed in this species is exceptional, but is a character of very slight importance from a systematic point of view. (Cf. anté.)

A few other statements made by Prof. Morse before the Boston Society of Natural History, Nov. 16, 1870, require notice. After reiterating the statements which I have just reviewed he calls attention to—

15. *Serial arrangements of setæ and gill-laminæ in Brachiopods as in Annelids.*

No serial arrangements of these organs (other than such as is seen in the branchiæ of Patella and various other mollusks) is to be observed in any of the many Brachiopods which I have dissected, nor does any such serial arrangement as occurs in the fasciculated setæ of Annelids obtain in any Brachiopod. This is a notorious and easily observed fact.

16. *Striated muscles absent in the Mollusca.*

This error is refuted in the same number of Silliman's Journal* which contains Prof. Morse's communication.

Transversely striated muscular fiber occurs in all the classes included under the type Mollusca, except the Cephalopods, where it will probably be found when carefully searched for. On the other hand, only one (Oligochætous) Annelid has been reported (by Ratzel) as having such fiber. The character, however, has no systematic value but is purely histological.

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* Feb., 1871, p. 123.

17. *Mr. Dall's startling homology of the peduncle of Lingula and the syphonal tube of a clam.*

I have never drawn any such homology; but have showed that the arrangement of the tissues in each is similar and should not be made the basis of any homology which does not include both.

18. *Mr. Dall's statement that because the setæ are not found the entire length of the peduncle, therefore, they are not identical with those of worms.*

I have never made any such statement or entertained any such idea. What I did state will be found in my first paper, and simply shows that being dissimilar, *per se*, they are, therefore, *not* identical.

19. *The bilobed lophophore and cephalic collar.*

The "lophophore" of Brachiopods is by no means universally bilobed, but is trilobed in most of the *Terebratulæ*, and four lobed in *Megathyris* and *Thecidium*. If Prof. Morse had studied the articulated brachiopods as thoroughly as he has the inarticulated forms, he would not have made this observation. His reference to the "cephalic collar," whatever that may be, is in itself and its bearing on the question, alike inscrutable.

Prof. Morse complains that I have overlooked the unisegmental "Vermes," and the more highly cephalized Annelids, and states that the former form a large proportion of the class. (Which class he refers to is doubtful, certainly it cannot be the Annelids.) But I am unable to see any characters in the forms he refers to which have not already been discussed, or are not of too little significance to have any bearing on the present discussion.

20. *The worms are invariably attached to a bivalve or multivalve shell, whether it be the scuta of Sternaspis, the oval plates of Lepidonotus, or the hardened integuments of others.*

It does not seem possible that any modern naturalist should seriously homologize the integument of a worm with the shell of a brachiopod. Such a homology is its own best refutation. As for the rest, where is the "hardened integument" of *Planaria*, or the *Trematoda* or the *Hirudinæ?* Where are the muscles by which they are attached to their "bivalve or multivalve shells?"

and how are these muscles attached? Homologies and muscles alike fail in such an emergency!

Prof. Morse likewise remarks that "*Sipunculus* and its allies claim it as a right to have an anterior termination to their intestine." I do not dispute their right, but it is very evident, from my preceding remarks on this subject, that they are very far from attempting to exercise it, on many occasions.

The other points brought up by Prof. Morse have been met incidentally or directly in the preceding observations.

The reader who has taken the trouble to follow out this train of reasoning will observe that there is not a single character of class or ordinal importance among those which Prof. Morse has brought forward. Most of them are histological and doubtful, and the sum of the whole may be comprised in the setæ and the oviducts. These have swollen to undue importance in his eyes, as has been already shown—and *per se* are not of much systematic value.

The following tabular comparison will illustrate the differences in the characters of real value in the several forms:

## SYNOPTICAL COMPARISON.

| *Mollusca vera.* | *Brachiopoda.* | *Annelida.* |
|---|---|---|
| Subœsophageal ganglion present, others scattered, not in a subabdominal chain. | Subœsophageal ganglion present, others scattered, not in a subabdominal chain. | Ganglia supraœsophageal and in a subabdominal chain. |
| Possessing a heart with or without pulsatile vesicles. | Heart and pulsatile vesicles present. | Without a heart and sometimes without vessels. |
| Intestine always bent. | Intestine bent. | Intestine usually straight, sometimes bent. |
| Fixed organically or free. | Fixed organically or free. | Always free or not organically fixed. |
| Setæ rarely present. | Setæ sometimes present. | Setæ present usually. |
| With or without organically attached calcareous shells. | With organically attached calcareous shells. | Without organically attached calcareous shells. |
| Mon- or diœcious. | Mon- or diœcious. | Mon- or diœcious. |
| With oviducts. | With oviducts. | With or without oviducts. |
| Always reproducing by eggs. | Always reproducing by eggs. | Reproducing by eggs or fission. |
| No sexual metamorphosis. | No sexual metamorphosis. | Often with two sexual forms. |
| Aquatic or terrestrial. | Aquatic. | Aquatic or terrestrial. |

The annexed homological diagrams will illustrate the principles under discussion.

We may now turn our attention to the additions and corrections which it is desirable should be made to my previous paper. The page numbers refer to those of the original paper, Am. Journ. Conch. vi, Part 2, pp. 88—168, 1870.

Pages 98, 107, 138. By an unfortunate wording the diagnoses of *Waldheimia* and *Kraussina* are made to read as if the mouth was situated outside of and behind the brachial disk, whereas the meaning intended to be conveyed was that the brachial cirri were not continued behind the mouth. This observation having been made on dry specimens, which did not convey the characters fully, should be eliminated; as elsewhere stated, the mouth in the Brachiopods is invariably situated within the brachial disk behind the great mass of the brachia, but before their posterior junction. In some species the cirri appear not to be continued behind the mouth, while in others they reach their greatest development in this position.

Page 98. *Eichwaldia subtrigonalis*, Bill., is from the Trenton limestone. Some information in regard to the interior of what Prof. Hall regards as an allied species, is to be found on pp. 274–8 of the XXth report of the Regents of the University of New York, Albany, July, 1868.

The type of *Leptocœlia*, Hall, is the *L. concava*, This was afterwards erected by Prof. Hall into a new genus, *Cœlospira*, leaving those species of which the interiors were still unknown, under the first name. This, however, is clearly inadmissable; the first name must be retained and *Cœlospira* falls as a synonym of it.

Pages 100, 154, 163–4–5. *Spondylobolus* has been misprinted *Spondylobus* throughout, and this was not noticed in the proofs. A similar misprint occurs in Davidson's Introduction to the Classification of the Brachiopoda.

The following is the synonymy of the order which includes the articulated *Brachiopoda:*

### Order *ARTHROPOMATA*, Owen.

*Arthropomata*, Owen, Enc. Brit. Ed. viii, xv, article *Mollusca*, p. 336, 1858.

= *Apygia*, Bronn, Klass. Ordn. Thierr. iii, 1st Abth. p. 301, 1862.

= *Articulata*, Huxley, Lect. Class. 1864. Intr. Class. An. p. 116, 1869.

Intestine ending in a closed sac. Lobes of the mantle united behind. Valves articulated by teeth and sockets.

## TEREBRATULIDÆ.

*Terebratula cubensis*, Pourtales, p. 105. (Bull. Mus. Comp. Zool. iii, pl. 1, fig. 2, 8—16, May, 1871.)

This species is unquestionably quite distinct from *T. vitrea*, to which it has been referred by some eminent European naturalists.

Among other points developed in numerous dissections of this species, were the apparent absence of the anterior prolongations of the "great pallial sinuses" in the anterior parts of the mantle lobes. The genitalia are very posterior and form a reticulated net work on each side of the muscular attachments, but do not pass before them.

In front of the occlusor muscles the tissues of the parieties appear to be thickened, or cellular tissue is interposed between the laminæ, forming a singular projecting mass which I have called the *nasiform body*, from its resemblance in shape to the human nose. Below the lower border, and more prominent portion of this body, is a groove, the *inter-corporeal groove*, and below this again, is a transverse mass, in structure similar to the first mentioned, shaped like a roll of parchment, which I have named the *supra-œsophageal body*. A small space exists between this and the posterior junction of the brachia behind the mouth. Spiculæ, like minute thorny brambles, were abundant in the tissues. The very young of this species have a kidney-shaped nucleus to the valves, of different texture from the remainder of the shell. The brachia are arranged in a single line around the edge of a semilunar membrane. There are no setæ at this stage, and the stomach is bag-shaped. This fry had the shell and hinge-teeth fully formed and of normal shape, but was without apophyses. It was ·02 of an inch in length.

## TEREBRATULINA.

Page 105. *T. marginata* and *T. quadrata* of Risso are to be added to the synonyms of *Terebratulina caput-serpentis* on Mr. Davidson's authority. The following additional localities are given for the species: Scandinavia, Sars; Sicily, Sequenza; Dalmatia, Brusina; Australia, J. W. Flower (?); Jamaica, Barrett; probably *T. Cailleti*, jun.

*Terebratulina Cailleti*, Crosse, off Chorrera, Cuba, in 270 fathoms; near Cosima in 450 fathoms; at Double-headed Shot Key, Tortugas, in 471 fathoms, and near Tennessee reef in 115 fathoms, United States Coast Survey Expedition, in charge of M. de Pourtalés. The specific name should be corrected to read as above. Crosse's figure is very poor, and represents an extreme variety. The normal form is remarkable for its elongated form, nodulous strong ribbets, large triangular foramen, straight hinge line and *Pecten*-like auriculation of the valves. It is very close to *T. michelottina*, Dav., Mon. It. Tert. Brach., p. 14, 1870, and they may be identical. It is hardly necessary to observe that it is perfectly distinct from *T. caput-serpentis*. The soft parts were crammed with spiculæ; one specimen had an enormously lengthened peduncle with a second attachment, like that of an ivy to a stone, half way between the terminal attachment and the shell. The occasion of this abnormal growth appeared to be the growth of a sponge upon the stones, which, but for the lengthening of the peduncle, would have enclosed the brachiopod and perhaps have killed it.

### Genus AGULHASIA, King.

*Agulhasia*, King, Am. Mag. Nat. Hist., 4th Series, vii, p. 109, 1871.

"Areigerous. Beak pointed. Deltidium closed by a plate fixed to the inner surface of the area. Foramen at the cardinal termination of the deltidium. Loop short, reflexed, and attached to the hinge by two crura. Shell substance permeated by branching tubuli."

Type *Agulhasia Davidsoni*, King, l. c. p. 111, Pl. xi, f. 1–8, Feb., 1871.

*Hab.* Agulhas Banks, south coast of Africa.

The above is Prof. King's diagnosis of a very minute shell (·25 inches in greatest length) which, from its solidity, appears to him to be mature. I trust I shall not be considered hypercritical in making the observation that, it appears to me to be a young *Terebratulina*, in which the crura have not become united, and which, nevertheless, is abnormally calcified. The fry of all the *Terebratulidæ* present a very similar appearance. The loop is that of a typical *Terebratula* but is perhaps immature, or the very delicate connecting band may have been broken away. Such fractures are very common, and I have examined a very large series of adult *Waldheimia cranium*, for instance, in vain for a single perfect example with the reflexed portion of the loop in its place. Mr. Jeffreys has had the same experience, as he relates in his British Conchology, p. 13, vol. ii. Prof. King says that (p. 110, note) he is not acquainted with any other Ancylobrach, in which the beak is not truncated for the foramen, except *Stringocephalus*. It is, nevertheless, true that none of them have it so truncated in the immature stages, as I have had many opportunities of seeing, and the Professor apparently forgets that his own genus *Gwynia*, and all the *Megathyrinæ* have it non-truncated in the adult condition, when perfect. The internal plate closing the posterior part of the foramen, is also more or less developed in all the young *Terebratulæ* that I have examined.

If the form in question be adult, it represents the immature stage of *Terebratulina*, and while it may, in such a case, have a subgeneric value, I think that this requires further confirmation. That it really belongs with *Terebratulina*, rather than *Terebratula*, may be inferred from the peculiar branching tubulation, first pointed out by Prof. King as occurring in *Terebratulina caput serpentis.* (Tr. Roy. Ir. Acad. xxiv, part xi, 1869.)

Prof. King himself, in a note, says that he has some grounds for suspecting that there is a closer relation between *Terebratulina* and *Agulhasia* than would at first sight be admitted. In this I agree entirely, and had the learned Professor had as good an opportunity for examining the young stages of the recent species as he has had for the adult fossil forms, I believe he would hardly have raised this one to the rank of a genus.

## WALDHEIMIA.

Page 110. *W. cranium*, Müll. This species has not been found in Japan, although so reported; the shells found and referred to this species do not belong to it. The "suture," or breaking point, described by Messrs. Jeffreys and Carpenter as existing in the loop of *W. cranium*, is due to the deposition of the laminæ of the loop in layers parallel with the longer axis of the valves, which makes the loop weaker at the point of reflection than elsewhere.

To the localities for *W. Grayi* may be added Sta. Cruz, Id., Purissima and Lobitas, California; Newcomb and Stearns.

*W. Raphaelis*, Dall (p. 111), is very much larger than either *floridana* or *septigera*, from which it appears to differ in anatomical characters as well, and may be considered as a well characterized species.

It has been further compared with other allied forms, and proves to be quite distinct from *W. septigera*, though belonging with it and *W. floridana*, in a peculiar group of the genus.

*Waldheimia septigera*, Lovèn, p. 112, (Bull. Mus. C. Zool. iii, pl. 1, fig. 4, and pl. ii, fig. 9) is quite distinct from *floridana* and from *T. septata*, Phil., which proves to be a *Terebratella*. It has not been found in Japan, and that locality should be erased.

*Waldheimia floridana,* Pourtalès (p. 112). (Bull. Mus. C. Zool. iii, pl. 1, fig. 3, and pl. 2, fig. 1–3.) This species, after comparison with a series of forms of *W. septigera*, kindly forwarded by Mr. J. Gwyn Jeffreys for comparison, appears to be very distinct, an opinion in which Mr. Davidson concurs. *Terebratula septata*, to which this species has been referred, is a fossil *Terebratella.*

### ? GWYNIA, King.

I am indebted to the extreme courtesy of Mr. J. Gwyn Jeffreys, F.R.S., for specimens of *Gwynia capsula*, Jeffreys, and the opportunity of examining his series of the very young of *Cistella lunifera*, *W. cranium* and *T. caput-serpentis.*

These all exhibit, more or less, the characters used as generic in the description of *Agulhasia* by Prof. King. Those in which the apex is perfect, preserve the kidney-shaped nucleus described by me in the young of *T. cubensis*, and observed by Prof. Morse in *T. septentrionalis.*

Mr. Jeffreys informs me that *W. cranium* has never been found associated with his *T. capsula*, though the other species mentioned are found with it. I notice that *W. cranium* is common in the Scandinavian seas, and *T. capsula* has been found by Sars at Christiania. The young of *T. cranium* resemble *T. capsula* very much; the specimens of the former are usually a little longer, and the valves more unequal. All things point toward the probability of *T. capsula* being an immature form, but of what species I am unwilling to express a decided opinion. It is certainly not a *Cistella* or "*Argiope*," and, if it eventually prove adult and distinct, the genus *Gwynia* must stand.

## MAGASINÆ.

### TEREBRATELLA.

Page 116. *T. transversa*, Sowerby, should be removed from the synonymy of *T. dorsata.*

Page 117. To the synonymy of *T. pulvinata*, Gld., should be added *T. pulvilla*, Gld., Cpr. Rep. Br. Assoc. 1856, p. 213 (name only).

Page 119. Having had an opportunity of examining Sowerby's Thesaurus Conchyliorum since my first paper was written, and having carefully compared the figures and remarks of different authors, I am convinced that *T. caurina*, Gould, and *T. transversa*, Sowerby, are one and the same thing. The latter name has four years' priority. To the synonymy should be added *T. caurena*, Cpr., Rep. Br. Assoc. 1856, p. 298 (name only).

Page 123. *Terebratella rubella*, Sby., is a *Laqueus*, and is the same as *L. suffusus*, n. s.? Dall, p. 125. Sowerby's name has priority. Mr. Davidson has compared specimens of *Laqueus suffusus* with the types of *rubella*, and finds them identical, though the coloration varies very greatly. In this decision I cheerfully acquiesce.

*Terebratella suffusa*, Reeve, p. 122.

Mr. Davidson, who possesses the typical specimen of this species, having examined the apophyses, kindly informs me that it possesses the "large elevated septum and loop of *Magasella*, to which subgenus it will require to be referred." The species described by me at p. 122, and figured (pl. vi, fig. 4) in my first paper, being a true *Terebratella*, and not, as I supposed, the species described by Reeve, may take the name of *Terebratella rubiginosa.*

Add *Terebratella spitzbergensis*, which is erroneously referred to the subgenus *Magasella* at p. 127.

### Subgenus ISMENIA, p. 127.

Zittel, in Dunker and Von Meyer's Paleontographica, Aug., 1870, has figured the interior of many species of fossil Brachiopods. Among them is *Terebratula pectunculus*, Schloth., which proves to have the lateral loops closed, so that it is nothing more than a *Megerlia*. The diagnosis of *Ismenia* on p. 127 refers to the recent species only. These shells, by their smooth surface, oblong shape, thin shells, and open lateral loops, differ greatly in appearance from the sculptured, transverse, thick *Megerliæ* with closed loops; and, since the *I. sanguinea* was the first species in Dr. Gray's Catalogue, it may be well to retain the name of *Ismenia* for the recent species alluded to above in a subsectional sense.

ISMENIA? JEFFREYSI, Dall. Pl. 11, fig. 7–10.

Under the name of *Frenula Jeffreysi* I published in the American Naturalist (V, p. 55, March, 1871,) a provisional description of a few lines referring to a shell which may be described as follows:

Shell magaselloid in external appearance, smooth, with an incomplete horseshoe-shaped foramen. Without a septum in either valve. Loop unattached, except by the hæmal processes to the hinge plate. Loop complex, somewhat like that of *Ismenia sanguinea*. Crura well marked, long and slender in the adult. Hæmal processes connected, the connecting band produced into a sharp point in the median line with a sinus above it; the point produced toward the hæmal valve, below the hæmal processes.

Lateral loops open. Anterior extremities of the hæmal processes produced into sharp points. Reflected portion of the loop broad, connected by perpendicular lamellæ to the hæmal band between the hæmal processes, and by lateral extensions to the hæmal processes themselves.

Shell smooth, waxen, with close conspicuous punctations; subcircular, compressed, with the margin of the valves nearly straight. Area marked by an incised line, deltidia wanting; the two separated parts of the area narrow, and very small. Beak of the hæmal valve rather prominent, smooth. Neural beak incurved, truncated, not prominent. Lon. ·34, Lat. ·33, Diameter ·17 inches. *Hab.* N. E. Atlantic; 155—345 fathoms with *W. cranium*, Jeffreys. Norway; with same, MacAndrew.

The specimen from which the above description was drawn up had the apophyses, which are accurately represented in the accompanying figures, in a beautifully perfect state of preservation. My largest specimen had the loop partially broken away but unmistakably belonged to the same species. None of the specimens had the slightest trace of a septum, and the shell appearing quite different from anything which has been figured in the works accessible to me, I felt justified, perhaps too hastily, in considering it as a new form. Since that time, by the kindness of Mr. J. Gwyn Jeffreys, I have had the opportunity of examining a number of young shells which had been referred to *Terebratella Spitzbergensis* and *Waldheimia cranium* as being the young state of one or the other of those species. One of these shells contained the apophyses in a perfect condition, but evidently abnormally distorted and malformed, being unsymmetrical and having the loops much compressed and abnormally united together. All of them possessed a filiform but rather stout septum. The appearance of these shells was so like that of the species above referred to, that, while I am not certain that they are identical, I feel pretty confident that they are the same, and that in the specimen figured and the others, which were broken, the septum must have been broken away, and left no trace of its existence. As it is slender and cylindrical it is possible that this may have happened. At all events, I am unwilling, without further material, to describe the shell more than specifically. The open loops, if the above surmises prove correct, would place it in the section *Ismenia* of the genus *Megerlia*.

*Megerlia truncata*, Lin., p. 130. *T. monstruosa*, Sacchi, must be removed from the synonymy of this species. It is a *Megerlia*, but a probably distinct species, according to Mr. Davidson. *Platidia Davidsoni*, Desl., may be a synonym of it, but the interior of this last is unknown, and judgment must be suspended until more material is obtained. Davidson (Italian Tert. Brach. Pl. xxi, f. 16,) figures *T. monstruosa*, Scacchi, under the name of *Platidia Davidsoni*, as he has subsequently informed me.

### MAGASELLA, p. 134.

Mr. Davidson thinks that the shell he figured and described as the type of the genus *Waltonia* was a mutilated, immature *Magasella*. As this is not *certain*, and the diagnosis of *Waltonia* would in no wise apply to *Magasella*, I have preferred to retain the latter name for the present, as there is no doubt as to what that stands for. But, if Mr. Davidson be correct, the name *Waltonia*, with a new diagnosis, should justly take the place of *Magasella*, on the sole ground of priority. The figure of *Waltonia* might represent a young *Terebratella* or other brachiopod, as in their young stages all the shells are very similar.

Page 137. "*Magasella*" *Spitzbergensis*, Dav., is a *Terebratella*. Add locality, "35 miles N. N. W. of Unst, 90—100 fms," Jeffreys.

Add *Magasella suffusa*, Rve., as previously noted.

Add *Magasella Adamsi*, Davidson MSS., Japan, A. Adams.

Add *Magasella inconspicua*, Sby. Thes. Conch. i, p. 359, pl. lxxi, f. 102—4, 1846. New Zealand, off Sinclair Head and in Lyall Bay, N. Z. Col. Mus.

This species resembles *Terebratella rubicunda*, Sol., in form and coloration, and was referred to that species, wrongly, by Reeve. It has the open foramen and septum of *Magasella* and should be removed from the synonymy of *rubicunda* and reinstated as a distinct species. I would add that some fine specimens of *T. cruenta*, Dill., (p. 117) having been received from the New Zealand Colonial Museum, show that it is perfectly distinct from *T. rubicunda*.

Add *Magasella Gouldii*, n. s. Plate 11, fig. 11.

Shell small, strongly ribbed with 18—20 radiating, rounded costæ, very transverse, cistella-shaped. Foramen large, incomplete, with a wide sharply defined flat area, and small, widely separated deltidia. Hinge teeth very strong, septum long, slender, hinge line of hæmal valve almost straight; hæmal valve nearly flat, neural valve rather deep, with a well defined median sulcus; interior white or reddish, outside yellowish, with red upon the ribs. Striæ of growth rather strong. Shell very thick and solid. Soft parts without a median brachial lobe. Yellowish. Apophyses as usual in *Magasella;* very slender. Lon. ·16, Lat. ·22, Diameter ·07 inches.

*Habitat.* Hakodadi, Japan, on *Terebratella coreanica ;* Stimpson.

One specimen, agreeing with no other described species, was found attached by its peduncle to an alcoholic specimen of *T. miniata*, Gld. = *T. coreanica*, Ad. & Rve., in the locality indicated.

## PLATIDIINÆ, p. 143.

### PLATIDIA, Costa.

*Platidia anomioides*, Scacchi, sp. (p. 143) has been obtained by M. de Pourtalès in two hundred and thirty-seven fathoms, off the Florida coast, and since by Mr. Jeffreys in three hundred and forty-five fathoms in the Shetland Channel. This is the second genus of Brachiopoda, *Crania* being the other, which has been added to our fauna by the researches of the U. S. Coast Survey parties. This species had previously been known only in the Mediterranean in deep water.

### Subfamily MEGATHYRINÆ, Dall, (p. 143.)

The diagnosis relating to the soft parts should be amended to read,

Brachia in a single series, following the loop surrounding a smooth untwisted membrane, in the median posterior part of which is situated the oral groove and mouth. Mantle edge without setæ.

The statement of Woodward that the mouth of *Megathyris* is situated in the centre of the brachial disk is an error, as I have since proved by dissections ; the mouth is in a position exactly equivalent to that obtaining in the other brachiopods.

### Genus MEGATHYRIS, D'Orb. (p. 144.)

It has been stated by some authors that Savigny's name was *Argyope* or *Argyopes*, and that therefore *Argiope*, Desl., is not preoccupied ; but this is an error, which a reference to the paper of Thorell or to the original work of Savigny will enable them to correct.

Add to the synonymy of *M. decollata*, *T. aperta*, Hidalgo ; *T. ungula*, Retzius, Diss., 1788 ; and *T. pectiniformis*, Costa, all on the authority of Mr. Jeffreys ; and to the localities, Atlantic coast of Spain, Jeffreys.

### Subgenus CISTELLA, Gray, (p. 145.)

Bull. Mus. Comp. Zool. iii, 19 Pl., f. 6, 6 a, May, 1871.

Add to the list on p. 146,

*Cistella* (*? Schrammi* var.) *rubrotincta*, Dall. Bull. Mus. Comp.

Zool. iii, p. 19, pl. , fig. 6, 6a, May, 1871. West of Tortugas, in 30—43 fathoms, Pourtalés.

Differs from *Schrammi* in color and sculpture, but may prove to be a variety of it, as the descriptions and figures of Crosse and Fischer exhibit some discrepancies. To the septum is attached a cordate nodulous transverse plate, not hitherto noticed in any species of *Cistella*.

*Cistella* (*? Barrettiana*, Dav. var.) *lutea*, Dall, l. c. p. 20, pl. 1, fig. 5, 5a, and pl. 2, fig. 4–8. Tortugas, 30—43 fathoms, Pourtalés.

This also differs in color and sculpture, as well as in the extent of the loop, from *C. Barrettiana* and *C. antillarum*, but may eventually prove conspecific. I have preferred in these two cases to give a provisional varietal name to the forms described, rather than unite what may prove to be different without positive proof. *C. Schrammi* appears to be distinct from *C. Woodwardiana*, but *C. antillarum* may very possibly have to be united with *C. Barrettiana*.

The frilled openings of the oviducts in the variety *lutea* are almost rudimentary, and there is no long tubular extension, but the opening for the genital products is directly in the midst of the rudimentary folds. The brachia behind the mouth are very much longer than the others. The ovaries hang upon the edge of a rather broad ribbon-like lamina, the heart is present but lower down than in most brachiopods, and quite small; no accessory vesicles were to bo found. The intestine is cœcal. There are no setæ in this or the last species.

*Cistella cistellula*, p. 146, is reported from the Mediterranean.

## Family RHYNCHONELLIDÆ.

Animal with two prolongations of the brachial disk spirally coiled inwards, with the apices of the coils directed toward the body of the hæmal valve. Punctate or impunctate.

Four oviducts and four accessory "pulsatile vesicles" present.

It appears to me that *Atrypa* and its allies would, from the position of the spires of the brachia, be placed more naturally in this family than in the *Spiriferidæ*. Prof. Theodore Gill has proposed a new family,—*Atrypidæ*—for these forms, but it is questionable whether the mere calcification of the spires is a family character.

The genus *Rhynchopora* has been proposed by Prof. King for the *Rhynchonella Geinitziana*, which possesses a punctate structnre.

I am indebted to the kindness of Mr. Davidson for information in regard to *Rhynchonella loxia*, F. de W., the type of the genus. Although referred by Bronn and Herrmannsen to *Spirifer cuspidatus*! it appears to be allied to *R. acuta* and other Liassic species, and is from the Jurassic formation near Moscow.

The name *Stenocisma* has been proposed for certain fossil *Rhynchonellæ* of the older rocks, on the ground that they differ from the recent species and from the *R. loxia.* The latter supposition would appear to have little foundation, but cannot be decided until the interior of *R. loxia* is worked out. It is much more likely that, if differences exist, they should be between the *R. loxia* and the recent forms, and that *R. loxia* should agree with the older fossil species. In this case a new name would be required only for the recent forms, for which the name *Hemithyris*, proposed by D'Orbigny for *R. psittacea*, would have to be used. The value of the differences, so far established, does not appear to be very great.

Add to the list of recent species (p. 153), *R. sicula*, Sequenza, Davidson, Mon. Italian Tertiary Brachiopods, ii, p. 23, Pl. xx, f. 6, 1870. *Hab.* Fossil in the Pliocene at Messina; recent off the coast of Portugal. Jeffreys.

### Genus DIMERELLA, Zittel.

*Dimerella*, Zittel, Dunker and Von Meyer's Paleontographica, Aug. 1870, p. 220.

Shell small, Rhynchonelloid, impunctate, with a large foramen. Neural valve with an entire edge, without a septum. Hæmal valve with a large, very prominent septum, which divides the cavity of the shell, when closed, into two chambers; with two stout, diverging, hook-shaped crura as in *Rhynchonella.*

Type *D. Gümbeli*, Zittel, l. cit. p. 222, Pl. xli, figs. 27--30. Aug. 1870.

In December (2d) 1869, Mr. J. Gwyn Jeffreys, F. R. S., published in "Nature" of that date, p. 136, the following remarks. "Among the mollusca were valves of an imperforate Brachiopod with a septum in the lower valve, which I propose to name *Cryptopora gnomon.*"

For some reason not stated, Mr. Jeffreys adopted a second name in his subsequent publications, and in the Preliminary Report of the Porcupine Expedition for 1869 (No. 121 of the Proc. Roy. Soc.) he states, "among the mollusca were valves of an imperforate Brachiopod, with a septum in the lower valve, which we propose to name *Atretia gnomon.*" (¶ 36, p. 421.) I have not seen specimens of either *Dimerella* or *Atretia*, but in a late communication, Mr. Jeffreys remarks, in regard to *Dimerella*

"It was published after my publication of *Atretia*, but I admit that the latter was not fully described. You are right as to the relationship, if not the identity of these genera."

It is for naturalists to settle which name should be adopted.

*Atretia gnomon*, Jeffreys, west of Ireland, in very deep water. 1000 + fms. ? Jeffreys.

## Order *LYOPOMATA*, Owen.

*Lyopomata*, Owen, Enc. Brit. Ed. viii, vol. xv., article Mollusca, p. 339, 1858.
= *Pleuropygia*, Bronn, Thierr. iii, 1st Abth. p. 301, 1862.
= *Inarticulata*, Huxley, Lect. Class. 1864. Intr. Class. An. p. 116, 1869.

Arms free, unsupported by shelly apophyses. Intestine opening by a lateral anus. Borders of the mantle lobes entirely disunited. Brachia without a distinct median lobe. Shell in most cases without hinge teeth, articulation, or cardinal process.

### Family CRANIIDÆ, H. and A. Adams.

*Craniidæ*, H. and A. Adams, Gen. Rec. Moll. ii, p. 583, 1858.

The complete synonymy of this family and its subordinate groups will be found in the Report already alluded to.

Shell hingeless, without perforation for a pedicel; attached by the entire surface or by the umbone of the lower valve, or rarely free. Upper valve suborbicular; lower valve subcircular or more or less pyriform. Four principal muscular impressions in each valve. Shell structure punctate. Arms spiral, free. Mantle extending to the edge of the valves, closely adhering, without setæ on the margin.

#### *Synopsis of the Family.*

Genus *Crania*, Retz. Shell attached, upper valve with the muscular impressions usually excavated but occasionally convex, without apophyses of any kind; inner surface vaulted without septa; impressions of the pallial sinuses flabelliform, separated in the median line in front. Margin of the valves rough, tuberculose or papillose. Type *Crania craniolaris*, Lin. = *Anomia craniolaris*, Lin., S. N. xii, p. 1150, 1767.

? Subgenus *Pseudocrania*, McCoy. Shell free, with the pallial impressions fimbriated and confluent in front. Anterior muscular impressions larger than the posterior ones. Margin of the valves smooth. Type *Crania antiquissima*, Eichwald, sp., McCoy, Annals Nat. Hist. viii, p. 388, 1851.

The value of this subdivision is doubtful.

Subgenus *Cranopsis*, Dall. Attached; upper valve with two slender pointed apophyses divaricating from the internal apex of the upper valve. Type *Crania Parisiensis*, Defrance, Davidson, Mem. Lin. Soc. Norm. x, pl. xiii, f. 23 a, b, 1856.

Genus *Craniscus*, Dall. Fixed valve divided by a transverse and a longitudinal median septum into three cells, the posterior of which contains the muscular impressions and the rostrellum. Tyye *Crania tripartita*, Munster, sp., Davidson, Mem. Lin. Soc. Normandie, l. c. fig. 21, 1856.

This is a very strongly marked section, and it seems extraordinary that it should have been allowed to remian with the typical *Craniæ* so long. The septa are not identical with the rostrellum.

*Spondylobolus*, McCoy (misprinted, on pp. 100, 154, 163, 164, 165, as *Spondylobus*), appears, as stated by McCoy, to be more nearly related to the *Lingulidæ* than to the *Craniidæ*.

*Pholidops*, Hall, appears congeneric with *Pseudocrania*, but, as it is chiefly known from casts, may be established by future researches as distinct.

### Genus CRANIA, Retzius.

*Crania*, Retz., Schrift. Berliner, Ges. Naturf. Freunde, Bd. ii, p. 72, 1781.
= *Cranicella*, Raf., 1815, + *Orbicula*, Cuvier, 1798, + *Orbicula* (pars), Lamarck, 1799, + *Discina* sp. Turton, 1822, + *Anomia* sp. Lin., 1760, + *Patella* sp. Muller, 1776, + *Siphonaria* sp. Quenstedt, 1852! + *Criopus*, Gray, 1821.

The full synonymy of this unfortunate group will be found in the report alluded to, with an exhaustive discussion of the nomenclature of the type and some other species.

Type *Crania craniolaris*, Lin. sp.
= *Anomia craniolaris*, Lin., S. N. xii, i, pt. ii, p. 1150, No. 216, 1767.
= *Crania brattensburgensis*, Retz. (pars), l. c. p. 73, 1781.
= *Crania nummulus*, Lam., An. s. Vert. Ed. i, vi, p. 238, No. 2, 1819.
= *Crania personata* (part), Lam., l. c. p. 238, 1819.
= *Ostracites numismalis*, Beuth., Jul. et Mont. subt. p. 130, t. 7, No. 46, 1776, *fide* Bronn. Ind. Pal.

A fossil species from Sweden, confounded with the recent species by Retzius, Gmelin, Dillwyn, Chemnitz and Lamarck.

The following are the recent species which may be referred to this genus:

*Crania Suessi*, Reeve, Mon. *Crania*, Conch. Icon. pl. 1, fig. 2, 1862, from Sydney, Australia.

*Crania rostrata*, Hoeninghaus, Mon. *Crania*, p. 3, No. 3, f. 3, 1828. Rve., l. c. pl. i, fig. 3, 1862.
Mediterranean and (?) West Africa.

I have received a specimen of this species from the Mediterranean through the kindness of Mr. Davidson. It is quite distinct from *C. anomala.* Deshayes' synonymy is very erroneous, and includes both *anomala* and the presumed variety *turbinata.*

*Crania anomala*, Müller, (as *Patella a.*), Prodr. Zool. Danica, 2870, 1766. Reeve, l. c. pl. i, f. 4, 1862.
= *Patella distorta*, Montague, 1808, *P. Kermes*, Humphrey, *Criopus orcadensis*, Leach, 1852. *Orbicula norvegica*, Cuvier, 1798, and Lamarck, 1801 (but not of Sowerby, 1822, Rang, 1829, nor Blainville, 1825), + *Criopoderma turbinatum et Criopus fimbriatus pars*, Poli, 1792, + *Crania personata*, Lamarck, 1819, + *Crania ringens*, Hœninghaus, 1828, + *C. rostrata*, Deshayes (pars), 1836 (not Hœninghaus), &c. &c.
North European Seas.

*Crania anomala*, var. *alba*, Jeffreys, Brit. Conch. v, p. 165, 1869.
Shetland and the Hebrides.

*Crania* (*? anomala* var.) *Pourtalesii*, Dall. Bull. Mus. Comp. Zool. iii, No. 1, p. 35, pl. 1, fig. 7, a, b, May, 1871.
Florida Keys.

The few specimens obtained by M. de Pourtalès differ in smaller size and in strong radiating rugosities, as well as in texture and color, from the typical *anomala.* A larger series of specimens will perhaps establish its specific rank. For the present, however, I prefer indicating it under a varietal name.

The seventy-four synonyms of *anomala* will be found in the Report already mentioned. I am indebted to Mr. G. W. Tryon for an examination of Poli's work and evidence as to its non-binomial character, which should exclude it from all strict synonymy. Mediterranean specimens received from Mr. Jeffreys establish the identity of *C. turbinata*, Poli, with *C. anomala.*

*Crania Japonica*, A. Adams, Annals and Mag. Nat. Hist. 3d ser. xi, p. 100, 1863.
Gotto Islands, Japan, 71 fms.
The muscular scars are exceedingly prominent.

## Family DISCINIDÆ, Gray.

*Discinidæ*, Gray, Syn. Brit. Mus. i, p. 155, 1840.
*Orbiculidæ*, King, Owen, Chenu, and the earlier authors.

Shell structure permeated with very minute tubuli; valves inarticulated. Attached to foreign bodies by a peduncle passing through the lower valve. Valves suborbicular, with a subcentral apex. Animal with free spiral arms; mantle very vascular, fringed with long chitinous setæ.

For synonymy of family, see my report in Bull. Mus. Comp. Zool. vol. iii, No. 1, June, 1871.

### *Synopsis of the Family.*

Genus *Discina*, Lam., 1819. Type *D. striata*, Schum.

Subgenus *Discina*, (sensu stricto).

Shell with subequal externally convex valves, with subcentral apices. Lower valve with a small subtriangular prominence in the centre, with a minute circular orifice for the pedicel, beneath it, from which an impressed line or furrow extends, on the inside, posteriorly. Shell of rather solid texture, impunctate, perforated by minute tubuli? Type *D. striata*, Schumacher, 1817, = *D. radiosa*, Gould, + *D. Evansii*, Davidson, + *D. norvegica*, Sowerby, + *D. ostreoides*, Lam.

Subgenus *Orbiculoidea*,[*] D'Orbigny (*Schizotreta* Kutorga.[†]

Shell similar to the last, but with the circular perforation at the posterior instead of the interior end of the furrow, which last is impressed from the outside instead of from the inside, as in *Discina*. Type *Orbiculoidea elliptica*, Kutorga, Davidson, Introd. p. 129, Pl. ix, f. 253–4–5, 1852.

Subgenus *Discinisca*, Dall. (= *Discina* sp. Auct.)

Lower value more or less flattened, concave or compressed, upper value more convex; apices of both subcentral, or subposterior. Lower value with a small septum as in *Discina*, behind which is a disk or area impressed from the outside, and traversed by a longitudinal fissure in the median line of the valve, extending from a short distance behind the septum, nearly to the posterior margin of the valve, which is often slightly indented behind it. Shell more or less horny in texture, minutely tubulous. Type *Discina lamellosa*, Brod., Rve. Conch. Icon. Pl. i, f. 4, 1862.

[*] Comptes Rendus, xxv, p. 269, 1847, August.
[†] Verh. Kais. Min. Ges. 1847.

Genus *Trematis*,* Sharpe, (= *Orbicella* D'Orb., l. c.)

Upper valve with a posterior apex and small false area. Lower valve flattened, with a large foramen extending nearly to the posterior border. Shell structure in two layers, the outer calcareous, with a peculiar reticulated sculpture. Inner layer horny, minutely tubulous as in *Discina*. Type *Orbicula terminalis*, Conrad, in Nat. Hist. N. Y. Part iv, Geology, by Emmons, p. 395, f. 4, 1842.

I am not prepared at present to admit *Siphonotreta* and *Acrotreta* into this family, but incline to the opinion of Kutorga, that they form a group by themselves.

*Keyserlingia*, Pander (Bull. Ak. Sci. St. Petersb. iii, p. 46, 1861. Type *K. reversa*, Pand. Pl. ii, f. 1, a—g.) appears to have relations with *Siphonotreta*, but its position is at present doubtful.

### Genus DISCINA, Lam.

*Discina*, Lamarck, Hist. An. Vert. vi, p. 236, 1819.
= *Crania*, *β*., Schumacher, Essai, p. 102, 1817.
= *Orbicula*, Sowerby, Min. Conch vi, p. 4, Pl. 506, 1830.
= *Orbicula*, sp., Lamarck and Owen.

Not *Orbicula*, Cuvier, Tabl. Elem. Regne An. p. 435, 1798, Lam. An. s. Vert. i, vi, pt. i, p. 242, 1819, Schum. Essai. p. 55, 1817,= *Crania*.

Type *Discina striata*, Schum. sp.

= *Crania* (*β*) *striata*, Schum. Essai, p. 102, Pl. xx, f. 1, a—f. 1817. (Not *C. striata*, Defrance). *Hab. ?*
= *Crania radiosa*, Gould., 1852. *Hab.* Cape Palmas.
= *Orbicula striata*, Sowerby, Thes. Conch. i, p. 366, Pl. 73, f. 9, 1847. Forbes and Hanley, Brit. Moll. ii, p. 368, 1853.
= *Orbicula norvegica*, Sowerby, Tr. Lin. Soc. xiii, p. 468, Pl. xxvi, f. 2, 1823. (Syn. exclus.) N. Africa.
= *Discina ostreoides*, Lamarck, An. s. Vert. vi, p. 237, 1819. No description.
= *Orbicula ostreoides*, Reeve, Conch. Icon. Pl. i, f. 7 a, b.
= *Orbicula Evansii*, Davidson, P. Z. S. 1852, p. 81, Pl. xiv, f. 32—34. *Hab.* Bodegas, Cala. in error.

Not *Orbicula striata*, Sowerby, Silurian Syst. t. v. fig. 21, 1839, and Siluria Pl. xx, f. 3. 1859, a fossil species.

Not *Orbicula norvegica*, Lamarck,= *Crania anomala*.

Not *Discina ostreoides*, Turton, Dith. Brit. p. 238, 1822.

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* Quart. Journ. Geol. Soc. No. 13, vol. iv, p. 66, June, 1847.

A full resumé of the synonymy, and a rectification of the same, will be found in the Report before alluded to. Carelessness in the identification of types and the neglect into which this and the last family have fallen, are the probable causes of the confusion which has hitherto pervaded them. These rectifications will perhaps meet with some opposition from those naturalists who forget that accuracy is the basis and aim of all Science. There can be no doubt as to the true type of this genus, and that it is as distinct from the forms which have been usually regarded as typical *Discinæ* on the one hand, as *Orbiculoidea* is on the other.

The following are the recent species. Those marked with an ! I have personally examined.

*Discina striata!* Dall ex Schum. l. c.

*Habitat.* North west coast of Africa.

*Discinisca stella!* Gould, Proc. Bost. Soc. Nat. Hist. vii, p. 323, Sept. 1860, Rve. Conch. Icon. Pl. 1, fig. 1, 1862.

Singapore and Philippines, Cuming. China Seas, Stimpson.

*Discinisca lamellosa*! Brod. P. Z. S., 1833, p. 124. Rve. Conch. Icon. Pl. 2, f. 3, 1862.

Panama to Peru.

This is the subgeneric type. I have examined an immense number of specimens from Panama and find that they exhibit many varieties. This species has no radiating striæ and is a thinner shell than *D. lævis.*

*Discinisca tenuis*, Sowerby, Thes. Conch. i, p. 366, Pl. 73, f. 4—5, 1847. Not of Reeve, Conch. Icon. Pl. 1, f. 5, 1862.

*Habitat?*

Reeve's figures of *Orbicula tenuis* do not represent Sowerby's species, but agree well with some of the varieties of *D. lamellosa.* I have seen no specimens of either, but the figures exhibit discrepancies too great to be reconciled. Sowerby gives no localities, and Reeve's localities, or one of them, probably refer to the form which he figures. It can hardly be found both in Chili and South Australia, and the double habitat is probably due to an error in labelling or identification.

*Discinisca lævis!* Sby., Trans. Lin. Soc. xiii, p. 468, Pl. xxvi, f. 1, a—d, 1822. Reeve, Conch. Icon. Pl. i, f. 4, a–b, 1862.

Concepcin, Chili, Cuming.

A specimen of this species was received from Peru, through Mr. Cuming, labelled *strigata*, Brod.

*Discinisca Cumingii!* Brod., P. Z. S. 1833, p. 124. Reeve, Conch. Icon. Pl. i, f. 6, 1862,= *D. strigata*, Brod. *fide* Rve.

Cape St. Lucas to Panama.

Mr. Reeve's figures afford no characters by which this might be distinguished from the last species. The specimens received under this name from Mus. Cuming cannot be distinguished from *D. stella*, Gould, by constant characters.

*Dincinisca? antillarum*, D'Orbigny, Moll. Cuba, p. 368, Pl. 28, f. 34–36, 1853. Reeve, Conch. Icon. Pl. 1, f. 2, 1862.

Cuba, Martinique, Cuming.

I have never seen this species which is stated by Reeve to resemble *D. stella*. It has relations with *D. Cumingii*, and a series should be compared.

*Discina* (*? Discinisca*) *atlantica*, Jeffreys, MSS.

North east Atlantic.

I am indebted to Mr. Jeffreys for information in regard to this species, which is on the point of publication in the Proceedings of the Zoological Society of London.

## Family LINGULIDÆ.

### LINGULA, p. 156.

Add to the list of recent species:

*Lingula affinis*, Hancock, Trans. Roy. Soc. p. 851, Pl. lxvi, f. 1, 2, 1857. E. Indies.

### GLOTTIDIA, p. 157.

The internal laminæ support the posterior retractor (adjustor of Hancock) muscles, not the post-parietals as suggested previously.

Add San Diego, Palmer, and Monterey, Cal., Stearns and Newcomb, to the list of localities for *G. albida*.

*Glottidia* (*? albida* var.) *Palmeri*, Dall.

Shell imperforate; texture moderately solid but contracting about the edges in drying; very narrow and elongated, rather square in front. Beaks sharply acuminated, valves in the natural condition rather widely gaping. Hæmal valve with a small concave area, transversely striated. Exterior of the valve with two obscure carinæ extending from the beaks to the anterior corners of the shell, and another, even less evident, in the median line. The posterior portion of the shell creamy white, extreme edges lightly horny; area between the two carinæ of a fine brown, stronger on the lines of growth and diminishing posteriorly; median carina paler. Surface polished, with obscure impressed lines and slight rugosities under a lens.

Interior whitish, not polished. When fresh all the organs are represented in a faint impression on the inner surface, but this becomes obscure when the shell is contracted by drying. Internal laminæ prominent. In all the specimens of this genus which I have seen the right lamina in the neural valve is a little longer than the other.

The muscles are attached on the inner concave edges of the laminæ. The muscular impressions are very small and obscure.* Length of shell 1·7 inches, greatest width 0·55 inches. Length of peduncle 4·5 inches. *Habitat* at the head of the Gulf of California on the Lower Californian side, opposite the mouth of the Colorado River; in sandy shelly mud at low water mark. Ten specimens, with the animal in alcohol, were collected by Dr. Edward Palmer. Cabinets Smithsonian Institution, W. H. Dall, Philadelphia Acad. Nat. Sciences, Thomas Davidson, Esq. and the Boston Society of Nat. History.

This magnificent species was collected alive by the indefatigable exertions of Dr. Palmer, who spent many hours groping in the mud after the small number of specimens above recorded.

I should have no hesitation in considering it a distinct species, coming as it does from a distinct zoological province, from the *G. albida*, but that the number of specimens of the latter (very rare species) which I have seen, is quite limited.

The principal differences are as follows:

The *albida*, as before described, agrees with the descriptions of Hinds, Reeve and Sowerby. The shell under my eyes differs from them in being much more elongated and narrow, proportionally, than the *albida*; the beaks are more acute, the internal laminæ are closer together and less widely divergent. The peduncle is very much longer, the brown color so conspicuous on the exterior is not found in *G. albida*, which also has a much more prominent median carina and a more solid shell which does not gape.

On the whole, the shell in question, if not a distinct species, as I am inclined to believe, is at least a very strongly marked variety and cannot fail to be recognized. It is longer and narrower than any other species and cannot be confounded with any described species. All the specimens were unattached.

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* The scars of the post-adductor are thickened and plate-like.

The anatomy of this species will form the subject of another paper.

### TRIMERELLA, Bill. and GOTLANDIA, p. 160.

In provisionally proposing the name *Gotlandia* for the shell figured by Dr. Lindström, I felt a slight doubt as to its distinctness from *Trimerella*, principally because figures, and especially restorations, are not infrequently insufficient representations of the objects intended. Still I could hardly question the plain statements in the paper alluded to. Since that time some misapprehension as to the identity of the fossils examined by me in Prof. Hall's collection having arisen, I have been indebted to the kindness of Mr. Billings for an opportunity of examining various specimens of *Trimerella*, both from Canada and from Götland. The latter were collected by Dr. Lindström.

The Canadian species are all casts in a calcareous rock and more or less incrusted with calc-spar. The specimens from Götland retain the shelly matter, but in a metamorphosed condition, so that the shell structure cannot be determined. Besides these, I have had the opportunity of examining a few specimens of another species from the Niagara group, collected by the Geological Survey of Ohio, in charge of Dr. J. S. Newberry, and in very poor condition. In these, the shell is only represented by rude incrustations of calc-spar, originally made over the shell which has since been entirely dissolved away.

Although these materials are anything but complete, they still afford some information. Among the Canadians specimens three forms of probably specific value appear to be represented, beside the species from Ohio, which appears to differ essentially from the others. With regard to the Götland shell the materials are not satisfactory for a full comparison.

One thing appears to be certain. In none of the American species is there any pit, interlocking process, or hinge-teeth, such as are figured by Lindström in his paper on the Götland shell.

The provisional genus *Götlandia* was suggested on the supposed differences above mentioned; if they do not exist, it of course, falls to the ground, and with it the figures and description upon which the characters were based.

On the other hand, though none of the Götland shells have the cardinal border well exposed, yet I am equally unable to discover anything of the kind there; though that it may not exist, I would not be understood as asserting. Dr. Lindström had doubt-less sufficient material upon which to base his description and figures, and I do not desire to impugn his statement on such slender material as that before me. Still it would have been satisfactory to have been able to confirm it.*

Several casts of what must be supposed to be the neural (ventral) or long beaked valve are before me. They are from the Guelph limestone of Canada. They appear to represent a spatulate or spoon-shaped shell, with an acuminated beak. The cardinal border is transverse (though slightly irregular) rather prominent and with an anterior convexity in the median line. The beak has a well defined, somewhat depressed, false area, with a rounded ridge on each side of it extending to the hinge-line. On each side of this ridge is a broad shallow gutter, between the former and the edge of the beak. The hinge line being very much arched, this groove is continued on each side, some little distance anteriorly outside of and beyond the most transverse portion of the hinge line. Over the whole of the beak are strong transverse rugæ or striæ of growth, which are especially prominent upon the area, but which are readily traced over the ridge and groove to the extreme edge of the beak at the sides. The margins of the valves appear to have been wide and thick as in *Crania*, but smooth. The beak somewhat resembles that of *Obolus*, or less that of *Acrotreta*, in its plane aspect. No subapical pit exists in the American fossils.

I am inclined to suspect that these shallow areal gutters are what have been considered as sockets or grooves for the insertion of the edge of the hæmal (dorsal) valve by Dr. Lindström. After careful examination of his specimen, I fail to find any grooves on the lateral margins of the neural valve, such as he figures. On the contrary, these are very wide, flattened and smooth. That in the American species these gutters cannot have served such a purpose is evident, for they are strictly confined to the lateral extensions of the area which was not opposed to any part of the opposite valve. The area, as noticed by Mr. Billings, is at an obtuse angle to the plane of the margin of the valves in most specimens.

The hollow processes, as indicated by the casts, differ considerably in different specimens. The hæmal valve appears to have had them more prominently developed than the other, in all cases. The median septum of this valve also seems to be more extended anteriorly than that of the neural valve. The internal tubular processes of the hæmal valve are, as Lindström represents them, abruptly raised from the surface of the valve or even overhanging it, so that they represent two cylinders side by side, with a gutter between them, which represents the top of a septum which is prolonged beyond their ends, anteriorly. In the neural valve, however, these cylinders are less prominent, and in some of the specimens the structure loses the appearance of cylinders and assumes the aspect of a plate or lamina, supported by a median septum and passing off into the body of the valve at its lateral edges, as described in the generic diagnosis of *Trimerella* in my first paper. In the Ohio species the internal arrangement differs somewhat in detail. Instead of the anterior ends of the cylinders being abruptly truncate, as in Lindström's figures, the upper edge is anteriorly produced and rounded off at the sides, so that it projects beyond the lower termination of its respective cylinder, while the septum is very prominent and also rounded and projecting above, over its attachment to the shell below.

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* It is possible that the *processus cardinalis* of Lindström may be, with the supposed cardinal pit, due to erosion of the much incurved beak of the hæmal valve, reciprocally with that part of the area opposite to it, in the neural valve, such as is occasionally seen in the opposed beaks of bivalves.

A note from Mr. Davidson confirms the existence, in some specimens, of a depression on the hinge-margin of the Gotland shell and a corresponding convexity in the dorsal valve, while corroborating my supposition in regard to the absence of the marginal grooves, as figured by Lindström.

The following provisional diagnosis comprehends the most evident characters.

### TRIMERELLA, Billings, 1862.

= *Trimerella*, Billings, Pal. Fos. Geol. Can. i, p. 166, June, 1862.
> *Trimerella*, Dall, op. cit. p. 160, 1870.
? *Trimerella*, Lindström, op. cit. p. 253, 1867.
? *Gotlandia*, Dall, (after Lindström) op. cit. p. 160, 1870.

Shell allied to *Obolus*. Neural (ventral) valve with a produced beak bearing a false area of which the middle part is more or less concave, and the whole of which is crossed by strong imbricated lines of growth. The plane of the area is at an obtuse angle with the plane of the margin of the valves. Hæmal (dorsal) valve with a more or less incurved apex, on either side of which is a small transversely striated area. Margins smooth, flat, thickened, rarely flexuous. Neural valve with a subtriangular plate, proceeding forward from beneath the hinge margin, more or less concave in the median line and more or less elevated above the body of the valve at its lateral edges. Supported below by a median septum which is usually prolonged beyond the anterior edge of the plate.

Hæmal valve with a similar arrangement, except that the plate is more convex on each side of the median line, more elevated at its lateral edges, and more deeply grooved over the septum, so that the apparatus presents the appearance of a pair of cylinders side by side, whose anterior edges are more or less flexuous, and with the septum longer and more prominent than in the neural valve. Shell calcareous, with concentric lines of growth, apex rather pointed, anterior margin broadly rounded, without a foramen, hinge teeth or interlocking processes.

The Götland specimens are too poor to state whether these characters are common to them. It is my impression that they will prove to be so, notwithstanding Dr. Lindström's figures.

Type *T. grandis*, Billings, op. cit. p. 166, f. 151, a, 6, 1862.

Characterized by a nearly straight hinge-line slightly flexuous in front, and by the large cavities below the neural lamina, not reaching the beaks.

*Locality.* Casts found in the Guelph limestone, middle Silurian, at Galt, New Hope and Elora, J. Richardson, J. Dalgleish, R. Bell and E. Billings.

*T. acuminata*, Billings, op. cit. p. 167, fig. 152. Pl. , fig. 4–5. Ibid. Am. Journ. Sci. Arts, 3d series, i, p. 471, June, 1871.

Characterized by the extension of the septum and cavities of the lamina into the beaks below and behind the hinge margin, which is narrow and straight. The valve below the lamina appears to have been somewhat thickened, so that the under surface of the cavities was raised above the body of the valve.

The shell represented by figures 4 and 5 is referred by Mr. Billings to this species.

*Locality*, with the preceding.

T. BILLINGSI, n. s. Plate 11, fig. 1, 2, 3.

Characterized by the lamina in the neural valve being hardly raised above the shell except at the anterior extremity; the septum hardly extending beyond the end of the lamina anteriorly; the area with a broad depressed transversely striated space in the middle, on each side of which are two longitudinal ribs or elevations, separated by a shallow gutter, across all of which the striæ of accretion pass without interruption; margins flat and nearly straight. Posterior margin slightly concave in the middle.

*Locality.* Guelph limestone, E. Billings.

One cast of a neural valve, showing the characters of the area, posterior margin, &c., distinctly, was kindly lent for examination and description by Mr. Billings. I have also seen two other specimens from the same locality.

T. MINOR, n. s? Plate 11, fig. 6. *

Characterized by the narrow median groove of the false area, and the striæ stronger outside of this than inside; the apparent absence of any lateral ridges or gutters on the area; the septum rising above the anterior part of the lamina in the median line; the flat but proportionally more elevated neural lamina and the straighter beak; a slight but conspicuous median flexure occurs in the anterior margin of one specimen, and is nearly wanting in the other.

*Locality.* Guelph limestone, Galt, Canada, E. Billings, 1857.

One certainly (and one probably) neural valve were received from Mr. Billings. There is a possibility that this may prove to be a form of the last species, but the character of the area appears very different. A much larger and more perfect series is needed to determine the specific range of these protean shells. It is certainly a *Trimerella.*

TRIMERELLA CONRADI, Hall.

*Obolus conradi*, Hall, 20th Regents Rep. on the State Cabinet, p. 368, Pl. 13 (4), f. 1, 2, 1867.

This species is probably a *Trimerella*, as Prof. Hall inferred in his description, though at that time, in deference to the opinions of Messrs. Davidson and Woodward, he placed it in the genus *Obolus.* It appears to differ from any of the other species here mentioned, in its broadly transverse shell, very short beak, and the form of the internal plates.

*Locality.* Leclaire limestone, upper Niagara group, at Leclaire, Iowa; and in a similar deposit at Racine, Wisconsin. Hall, loc. cit.

T. OHIÖENSIS, Meek.

*T. ohiöensis*, Meek, Sill., Am. Journ. Sci. and Art. p. 305, April, 1871.

Characterized by the strongly flexed posterior margin and deeply incurved hæmal beak; large and very prominent tubular processes, almost equally so in both valves; the anterior end of the septum raised and rounded, very prominent, the anterior ends of the cylindrical processes flaring and oblique, the upper edges overhanging and effuse.

*Locality.* Niagara limestone, Genoa, Ottawa Co., Ohio. Sinking Springs, Ohio, I. S. Newberry. Guelph limestone, Canada? one valve, E. Billings.

* [illegible] Davidson writes me, after [illegible] the type specimen loaned to him by Mr. Billings, that this is not a Trimerella, but [illegible] Rhinobolus; and that it [illegible] sometime back by Mr. Billings as O. Galtensis

Three specimens and some fragments collected by the Ohio Geological Survey, appear to belong to a distinct species for which Mr. F. B. Meek has proposed the above name.

? T. LINDSTROMI, Dall.

= *Trimerella* sp. Lindström, Ofv. Vet. Ak. Förk. xxiv, p. 253–7, Pl. xxi, 1867.
= *Gotlandia Lindstromi*, Dall, l. c. p. 161, 1870.
Not *Trimerella grandis*, Bill.

Were the character of this species certainly such as Lindström ascribes to it, it could not remain in this genus. I am inclined to believe that it does not differ generically from the American species, however, though the material at my command will not suffice to determine the question or even to characterize the species. It must therefore remain for the present in abeyance. It seems to be most closely allied to *T. ohiöensis*. Mr. Davidson having obtained the necessary material, will undoubtedly settle the question in a satisfactory manner.

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## REFERENCES TO THE FIGURES.

### PLATE 10.

Fig. 1. Diagram of a bud of *Rhabdopleura*, a marine polyzoön, after Allman.

2. Diagram of *Phallusia*, a Tunicate, after Huxley.

3. Diagram of *Appendicularia*, a free Tunicate, after Moss. The appendix is represented as if cut off near the body.

4. Diagram of an articulated Brachiopod. Original.

5. Diagram of a *Lingula*, an inarticulated Brachiopod, after Hancock.

6. Diagram of a *Chiton* with ambient gills, after Middendorf.

7. Diagram of *Mya*, a lamellibranch, after Allman.

8. Diagram of *Buccinum*, a marine gasteropod, after Huxley.

9. Diagram of *Gadinia*, a pulmonate gasteropod, with a hæmal flexure of the intestine. Original.

10. Diagram of *Pompholyx*, a pulmonate gasteropod, with a neural flexure of the intestine. Original.

11. Diagram of a *Cephalopod*, after Huxley.

12. Explanation of the signs used in the diagrams preceding. a, branchial apparatus; b, mouth; c, heart; d, ovary and oviduct; e, sub-œsophageal ganglion; f, anus.

## PLATE 11.

Fig. 1. Neural valve of *Trimerella Billingsi*, from a mold taken from the natural casts by means of gutta percha. Slightly restored.

2. Side view of both valves of *T. Billingsi* in juxtaposition. Restored from the casts.

3. Section of the same.

4. Hæmal valve of *Trimerella acuminata,* Bill., (Canadian) from a gutta percha mold.

5. Side view of hæmal valve of *Trimerella acuminata*, Bill., from a mold. Restored (Ohio).

6. *Trimerella minor.* Slightly restored from a mold of a neural valve.

7. Apophyses of *Ismenia?* (*Frenula*) *Jeffreysi*, much enlarged, from behind.

8. The same, from in front.

9. Side view of the same.

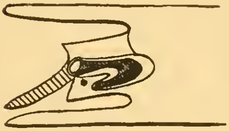
10. *Ismenia? Jeffreysi*, two and a half times the natural size.

11. *Magasella Gouldii*, three times the natural size.

*Note.* There is every reason for supposing that the restorations of the *Trimerella* here figured are essentially correct, yet, as in all restorations, it is possible that there may be some deficiencies in the representation of the more minute details.

The diagrams on the preceding plate are made as simple and as diagrammatical as possible, being only intended to show the relative position of the several parts represented by arbitrary signs.

American Journal of Conchology 1871. Plate 10.



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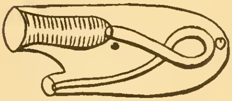

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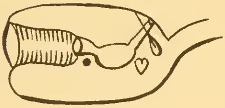

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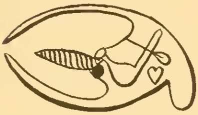

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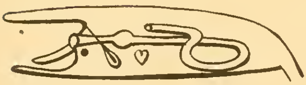

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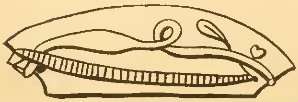

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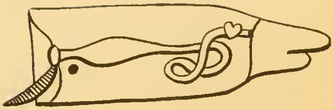

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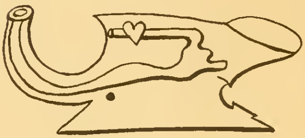

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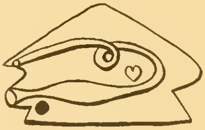

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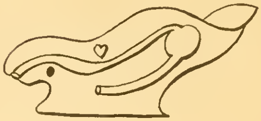

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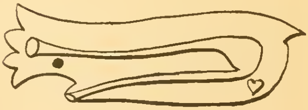

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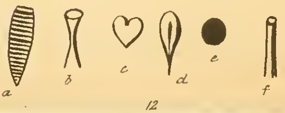
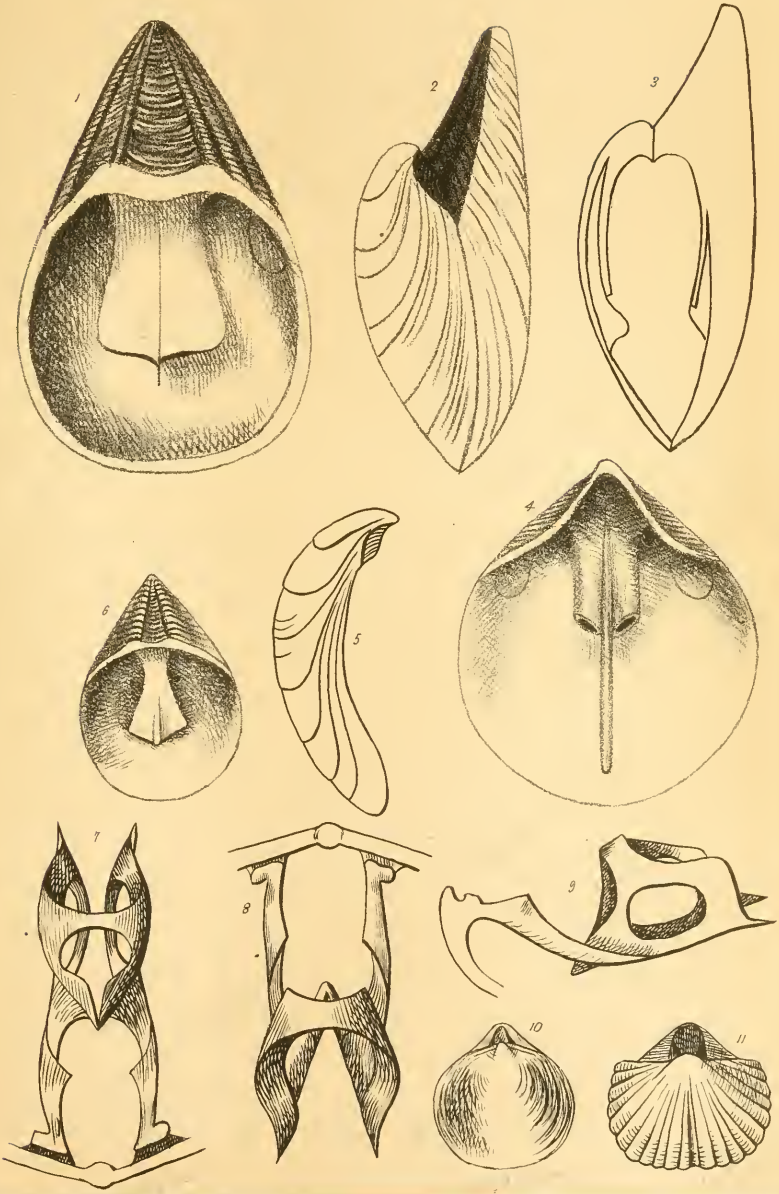


12

W H DALL, DEL.

Dall, On Brachiopoda

American Journal of Conchology-1871. Plate II.



W.H. DALL, DEL.

Dall, On Brachiopoda.